Smithsonian

GUST 1998

SPONGES
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[PAGE 50]

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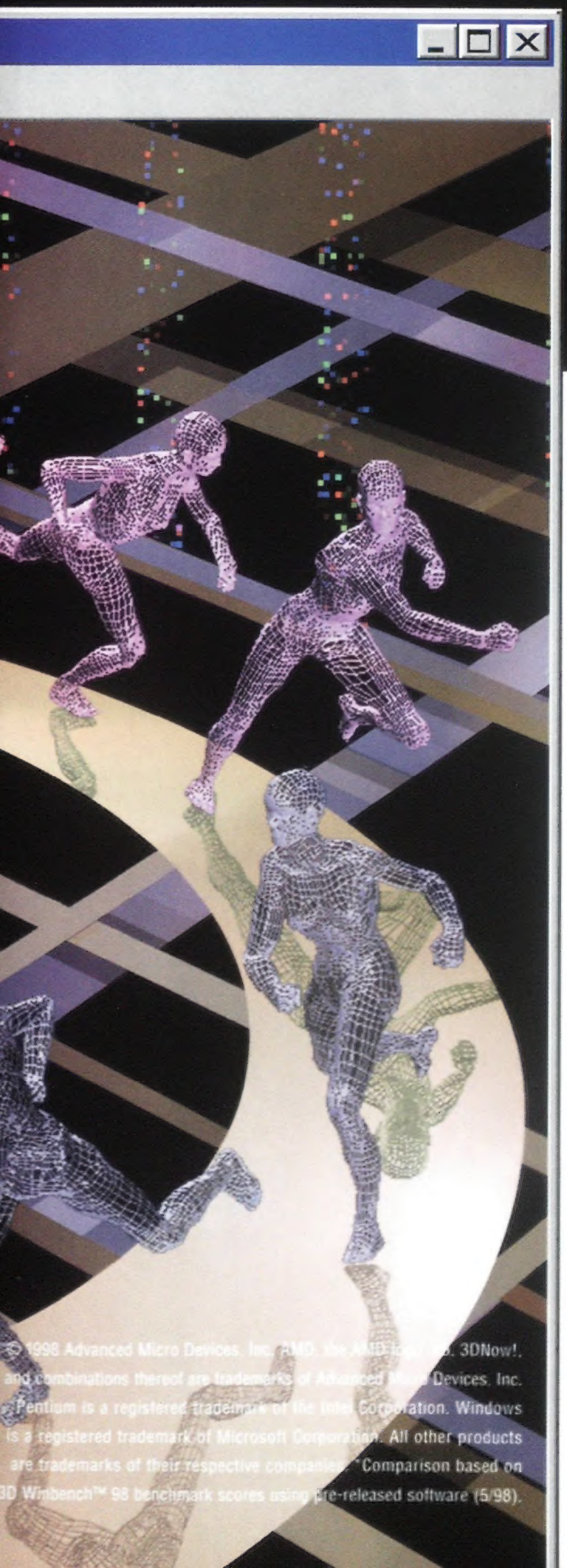
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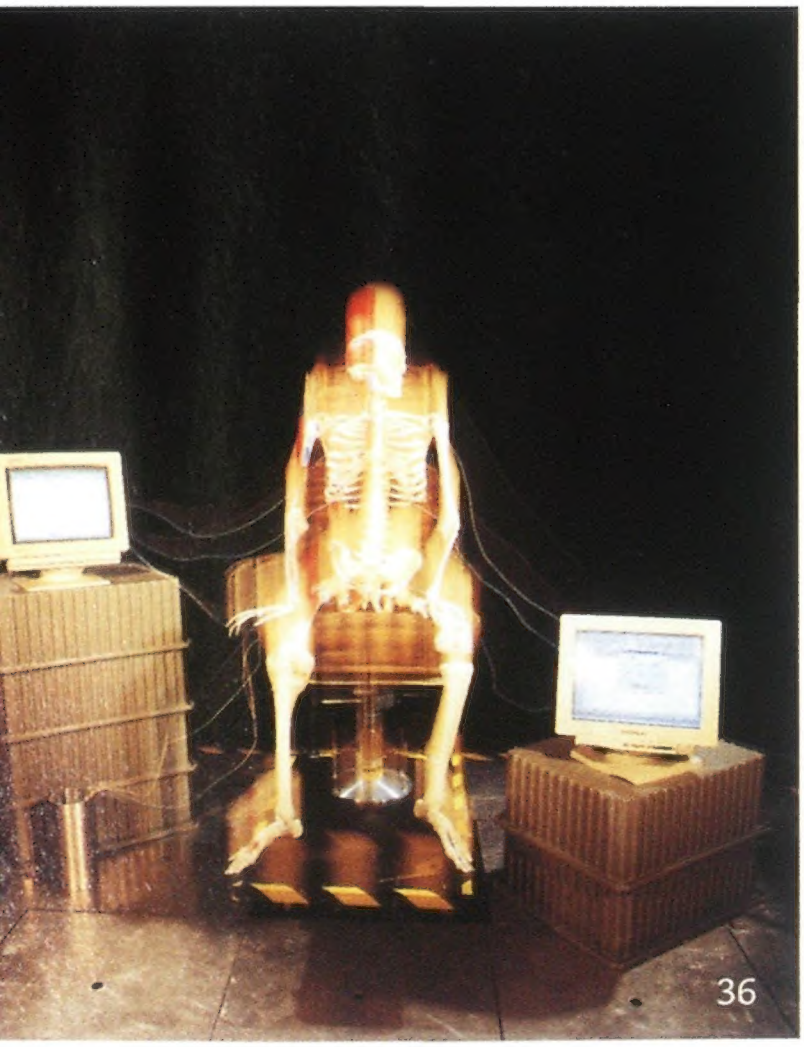
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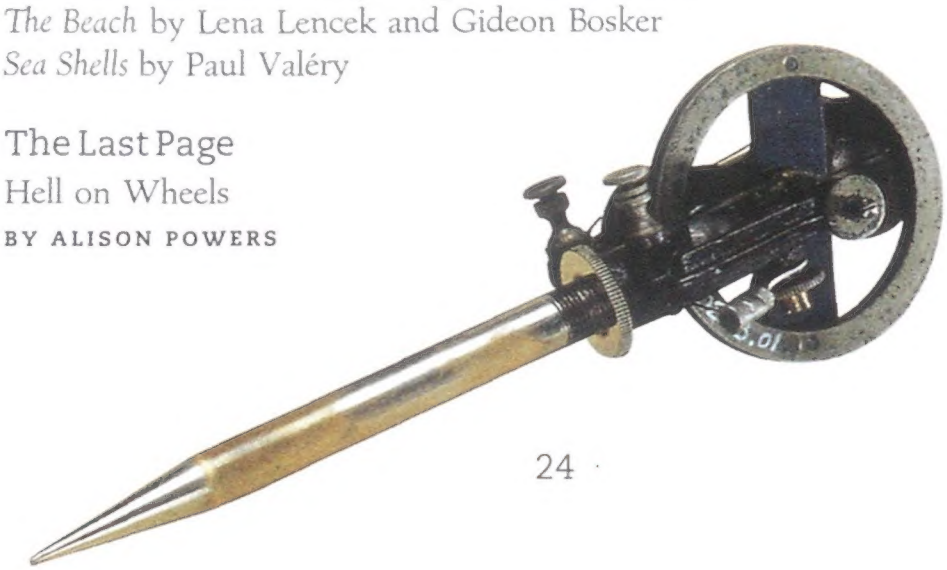

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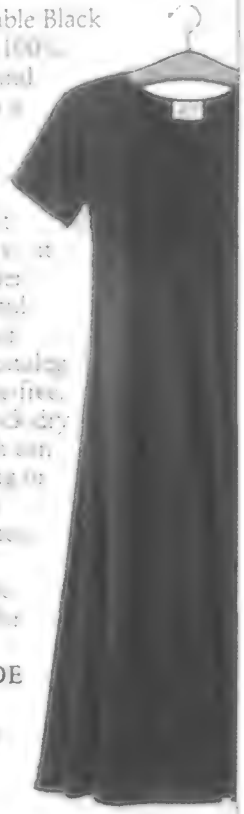

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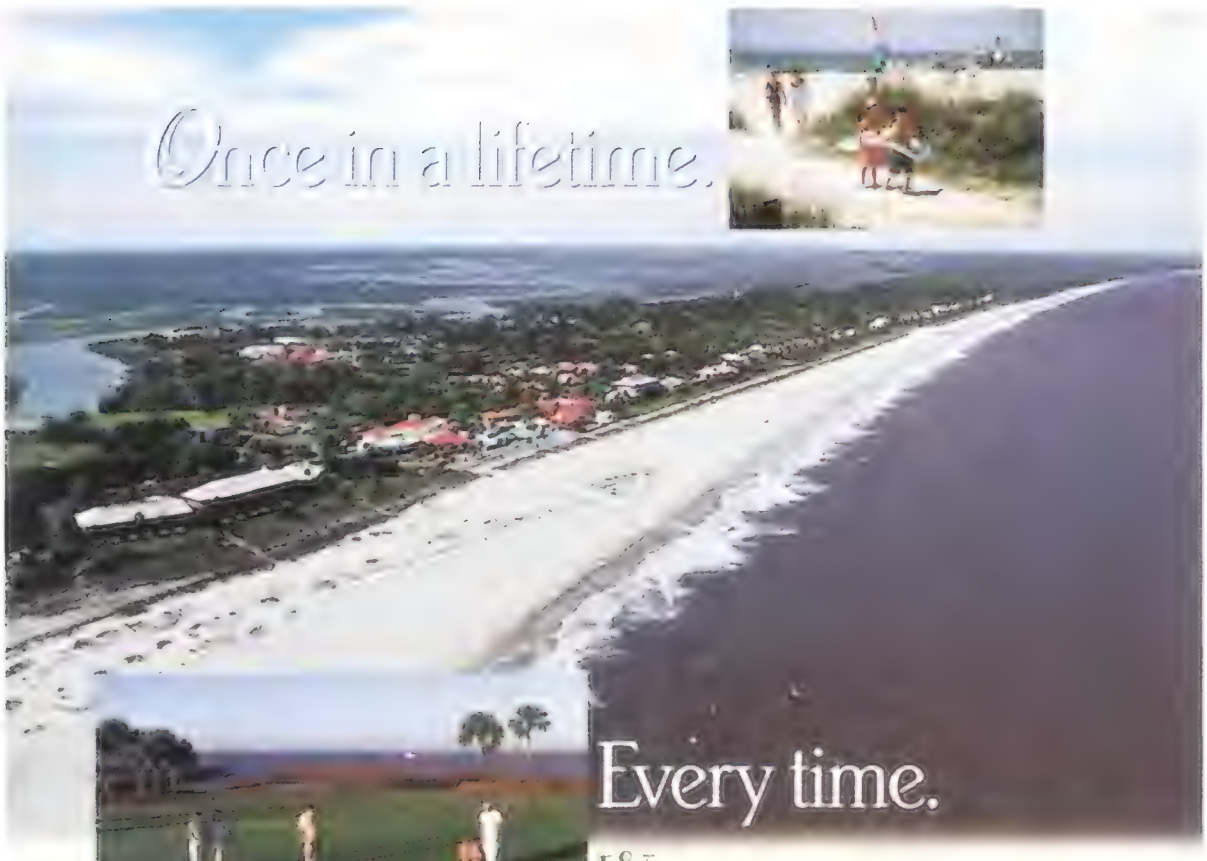

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To improve our Original Oxford, we had to go behind your back.

When you get right down to it, our *original* Original was only the beginning.

Ever since Lands' End introduced this buttondown 20 years ago, we've been tinkering with it, adding new features. (Truth is, we do *that* with all our products.)

So, why are we going back to its back? Because we've found a way to make it sit better on your shoulders – and look better, too.

It's something called a mitered split back yoke. Which takes a little explaining...

Take it from the top

Remember the yoke that milkmaids used to carry their pails? Well, that's probably where tailors got the name for *their* yoke.

It's the part of a shirt that runs across the back, from shoulder to shoulder.

In classic British tailoring, the yoke isn't one piece – it's four separate pieces sewn together.

This allows the shirt to *give* a little at the seams when you bend or stretch. (OK, so far?)

Now, in a *mitered* split back yoke, the pieces are cut on a slight angle. Mitered, just like in shop class.

So, the shirt gives diagonally – in the direction of the fabric's own natural "give."

Voila! Our Original Oxford feels roomier, and yes, looks better.

While we were changing our shirt...

We've also made the buttonholes on the sleeves *horizontal*, instead of the usual vertical holes. A small touch – but again, a sign of fine tailoring.

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SMITHSONIAN PERSPECTIVES

One Under the Sun

WITH A NEWLY REFURBISHED LOGO, THE SMITHSONIAN REAFFIRMS ITS UNITY OF PURPOSE

IF A "SWOOSH" EMBLAZONS YOUR ATHLETIC SHOES, everybody knows what brand you are wearing. If you are carrying a bag with golden arches printed on it, it's clear where you have just picked up a hamburger and french fries.

A logo is a powerful symbol. It immediately defines an association between a product and its corporation. The Nike swoosh and McDonald's golden arches, for example, have become so recognizable on the consumer landscape that the companies' products can be identified in a single glance. At the Smithsonian, our goal, too, is instant recognition.

Throughout the Institution's 152 years, several logos or seals have represented the Smithsonian's mandate, starting with benefactor James Smithson's profile in 1847. During the late 19th century, a globe flanked by torches of knowledge was printed on annual reports and publications; it endured until 1966, when the sunburst, also a reference to enlightenment, came into use. Many other symbols, however, have proliferated among our museums, research institutes and offices. Almost every Smithsonian organization has its own emblem or logo. The brink of a new century presents the right moment to reevaluate the spread of these graphically rich but often confusing symbols and to affirm the unity of the Smithsonian Institution in a single logo.

During our 150th-anniversary celebration two years ago, we reflected on how much this institution has grown since Smithson's bequest. We are now complex and far-flung, embracing a wide field of arts, sciences and humanities. As we seek to present our funding needs to Congress or to corporations, and to articulate our vital role in American society, we need a unifying symbol to graphically cement the relationship of our many parts to the whole.

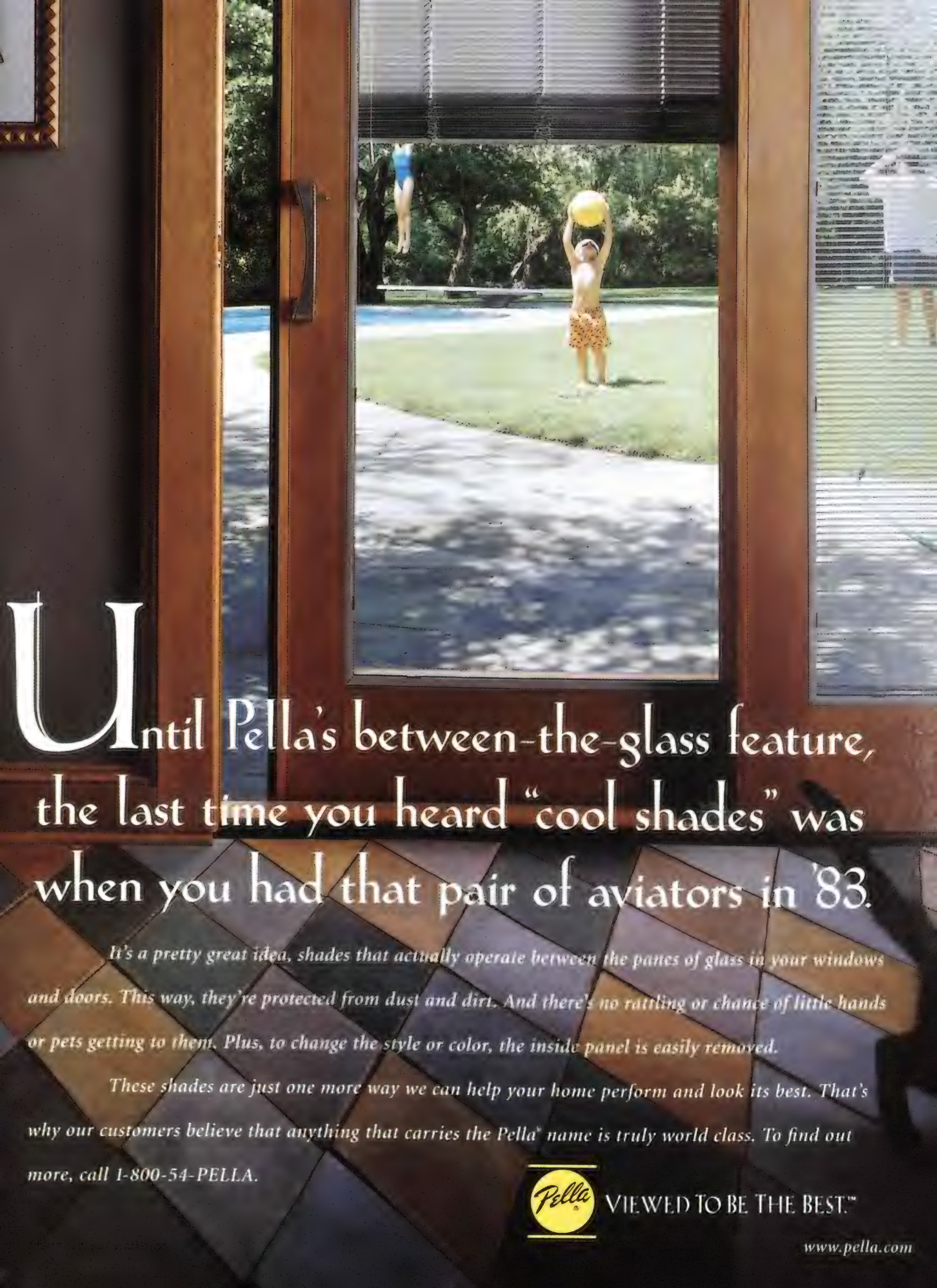
We also learned from a 1995 market research survey that more than 80 percent of those polled nationwide knew of the Smithsonian. While general impressions of this vast institution were positive, they were also somewhat vague. Most respondents associated historical, environmental and technological pursuits with the Smithsonian and recognized that it is largely museum-based, with distinctively American collections. Few mentioned that it embraces African and Asian history and art, that research plays as important a role as museum exhibitions, that art is no second fiddle to science and history, or that the Smithsonian's physical presence extends beyond the National Mall.

These survey results, combined with the experiences of communicating the Smithsonian's programs and needs during our 150th anniversary, taught us how critical it is to be able to portray an organization's core identity quickly, gracefully and directly. Being an institution whose identity is so bound up with history, we chose as a symbol on which to build our future one that is also part of our past: the sunburst.

The updated sunburst and its accompanying logotype, shown here, were designed by the New York firm of Chermayeff & Geismar, Inc. This refreshed sunburst and typeface will replace the logos of all individual museums, research institutes and offices this month. The beauty of this design is that Smithsonian entities will be able to assert their individuality with their name appearing below that of the Institution.

In the business world, this is the concept of brand identity. Though the Smithsonian operates in what many think of as the nation's noncommercial cultural life, we are bound by many of the same pressures that weigh upon those in the corporate domain. We believe that knowing who we are and being able to communicate that identity clearly and confidently to the public is best achieved in a single graphic representing both our sum and our parts. If we are to be successful in attracting the support we need, now and into the next century, to sustain our multiple departments, activities and service to our audiences, the Smithsonian must express those needs with one voice, with one image. The span of our programs may be great, but we are bound together by one core identity and our mutual commitment to the increase and diffusion of knowledge.

I. MICHAEL HEYMAN, SECRETARY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ELMS

THE EXCELLENT ARTICLE BY RICHARD Wolkomir on the embattled elm in the June issue mentioned that Dutch elm disease moved from one infected elm to a healthy neighbor through intertwined roots. More to the point, intertwined roots often grafted to one another, which is what enabled the disease to pass from tree to tree and spread like wildfire through cities and towns that had homogeneously planted their streets with American elms. The tough lesson that urban foresters have learned from this catastrophe is to plan for a diversity of tree species in our community forests.

Now that disease-resistant elms have been identified, some people want to conduct wholesale planting of these trees, hoping to reconstruct the beautiful cathedral effect characteristic of the past's elm-lined streets. As desirable as this may be, the project could court disaster if the disease overcame even a single tree's resistance. These cloned trees are resistant, not immune, to Dutch elm disease. While disease-resistant elms are an exciting development, they should be planted judiciously, with careful thought and planning.

Randall H. Miller
Bountiful, Utah

Denny Townsend of the National Arboretum agrees that urban tree monoculture is risky. He says that urban and suburban communities should plant no more than 10 percent of one species and no more than 20 percent of one genus of trees. No related trees should be planted close together in continuous rows covering long distances.

HOUSE TRAILERS

I HAVE A FOOTNOTE TO ADD TO THE entertaining and informative article by Chiori Santiago on house trailers. From 1943 until 1945, Hanford Camp in the state of Washington had spaces for 4,300 privately owned trailers. It was the only housing provided for married couples at the construction site for the Hanford Engineering Works of the Manhattan Project that manufactured plutonium for the Trinity and Nagasaki atom bombs. Seventy-six spaces were segregated from the rest for black couples.

D. Louis Hamilton
Kennewick, Washington

THE OCEANFRONT COMMUNITY PICtured on page 80 is the Palisades Bowl, not its next-door neighbor Tahitian Terrace.

Ellen Rome Shanahan
Pacific Palisades, California

YOU MISSED ONE IMPORTANT FACET of life in the Trailer Estates community. The gentleman seen riding the tricycle on page 79 is my 95-year-old father-in-law, Matthew Donati. Every day he puts in about four miles.

Thomas G. Crouthamel, Sr.
Bradenton, Florida

JUDGE ROY BEAN

HOLLYWOOD, TELEVISION AND NOVelists have scarcely done justice to Judge Roy Bean. Bruce Watson's straightforward account without the additional fiction is story enough and was a welcome read.

The article implied that the Headquarters, the saloon where Bean tended bar for his brother Joshua, was in San Diego. It was farther north, in San Gabriel.

Paul Young
Adin, California

THE VINEGAROON, OR WHIP-SCORPIon, which gave its name to the former Texas railroad camp, is not a true scorpion. The arthropod is not venomous, but when it is disturbed, it curls its stiff "whip tail" upward and sprays a substance, mostly acetic acid, that smells like vinegar. In an environment where everything sticks, stings or stinks, the vinegaroon is a relatively harmless survivor.

Phil Thomas
Atlanta, Texas

BLIMPS

MISSING FROM YOUR ARTICLE ON blimps by Charles N. Barnard is the first rigid airship, which Austrian David Schwarz invented. Schwarz spent much of his fortune and a decade of his life researching, developing and building a wire-braced tubular and latticework rigid frame covered with sheet aluminum. The result was a huge cylindrical vehicle with a pencil-shaped nose and a gas-filled compartment inside. The hull of Schwarz's first airship collapsed in 1893 before it could be test-flown. Schwarz died in January 1897. On November 3, 1897, the Schwarz dirigible took off from what is now Tempelhof Airport in Berlin and flew four miles before crash-landing.

Herman Herzberg
Falls Church, Virginia

YOU HAVE UNDERREPORTED THE number of people who died in the three airship accidents that you mentioned in your article. The total number of fatalities for the *Shenandoah* was 14; for the *Akron*, 73 Navy ship crew plus 2 Navy ground handlers; and for the *Macon*, 2—a total of 91. Two members of blimp *J-3*'s search party died in an accident while looking for survivors of the *Akron* crash.

Joseph S. Algranti
Chapel Hill, North Carolina

WRITE TO SMITHSONIAN

Send letters for consideration in this column to SMITHSONIAN Letters Editor, P.O. Box 44400, Washington, DC 20026-4400 or to LettersEd@simag.si.edu.

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Alex Tehrani shooting
Kodak Royal Gold 100 film.

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Philip Hall

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AROUND THE MALL & BEYOND

Sharing the Gift of Music

AN ENDOWMENT ACCOMPANYING RARE INSTRUMENTS LETS THEM BE HEARD IN PERFORMANCES AND ON RECORDINGS

BY MICHAEL KERNAN

A FEW MONTHS AGO A REMARKable man named Herbert Axelrod donated two Stradivari violins, a Stradivari viola and a Stradivari cello to the Smithsonian, creating what is now known as the Axelrod Quartet.

The gift was accompanied by a $1 million endowment to support performances by the Smithsonian Chamber Music Society. The instruments have been appraised at $50 million, though Axelrod has turned down offers as high as $55 million.

A self-taught ichthyologist, Axelrod made a fortune publishing handbooks on pets, especially tropical fish. Recently he sold the business for a reported nine figures. Since then he has given money away to various music institutions and museums, including a $1.5 million endowment to the National Museum of Natural History's Division of Fishes.

The Strads came to him in the 1980s, and he promptly loaned them to the National Museum of American History. Late last year he turned the loan into a gift, one of the largest ever for the Smithsonian.

All right. These fiddles are around 300 years old. If you are serious about violin playing, you can pay from $20,000 to $250,000 for an instrument. It probably will be old, and likely will be Italian, but chances are it won't be anywhere near a Stradivarius for glamour, not to mention tone.

So what is it that makes a Strad so valuable, exactly?

I talked to Gary Sturm, who more than anybody else is the person who made the gift happen. It was Sturm who drove up to New Jersey any number of times just to talk about violins with Axelrod. "I spent a lot of time deciding where to put them," Axelrod told one reporter, "and decided on the Smithsonian. Gary impressed me with his knowledge and his caring."

A quartet of Stradivari instruments, donated by retired publisher Herbert Axelrod, is one of the richest gifts in the Smithsonian's history.

Sturm almost didn't make it to the Institution. A graduate of Beloit College with a degree in mathematics, he had been bitten by the violin bug – "I got onto this thing about violins, I can't explain why, maybe because I wanted a craft"—and worked for two years as an apprentice to Washington, D.C. violin maker Willis Gault.

"I didn't get paid anything, but it was a side-by-side working experience," he told me. "Finally, I knew I needed to move on, and I came to the Museum of American History."

After a spell of volunteer work in the conservation lab, he was offered a paying job at last—a typing job. It took him 12 tries to pass the test, but he was where he wanted to be, the Division of Musical Instruments. That was 20 years ago. He's now assistant chairman for special projects at the Division of Cultural History, where those instruments reside.

But back to the Strad. I had heard

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all the stories: how the master used to roam the forests of northern Italy and tap on certain trees and mark them for his future use, how he invented a magical varnish that no one can duplicate—the secret of his greatness.

Sturm laughed. "Well, I'm not sure he actually went around tapping trees, but a violin maker does examine the straightness of a tree and the soil around it: a slower-growing tree is better because it makes for a tighter grain. Now all you do is go to the lumberyard. But the wood needs to be aged, and it must be quartersawn."

That is, the log is sawed lengthwise in quarters, and the top, or belly, of the violin is fashioned by joining two of these wedge-shaped pieces. When a piece is looked at edge-on, the growth rings appear as straight parallel lines. This grain gives the wood maximum strength. Otherwise, under the 70 or 80 pounds of pressure from the stretched strings and the narrow bridge, it would buckle.

The violin's sound is made by drawing the bow across the taut strings. The sound travels down to the foot of the bridge, where it is transmitted to the entire top surface of the instrument, which vibrates.

There is another element here, the sound post. This is a pencil-thick stub of wood that stands between the top and back. "The sound post transmits the vibration to the back piece, amplifying the sound still further," said Sturm. "Without the sound post you'd lose a lot of power."

About varnish: put it on too thickly, make it too brittle, and it can kill the sound of a violin.

"You can take a badly made violin," Sturm contended, "and no varnish in the world will make it sound good. The varnish protects the instrument and helps retain its flexibility. Because we don't understand how Stradivari made his varnish or put it on, we like to think this is some magic that explains the great tone. But there's the selection of the woods, the volume of air inside the violin, the flexibility of the wood itself," Sturm maintained.

"Even if the instruments travel, we use them under controlled circumstances. We have security guards, and humidity and temperature controls."

One reason why a good old violin is generally preferred to a good new violin is that the wood changes over the years. The resins in wood gradually dry out, leaving the pores, the cellular structure of the wood, open. This makes the wood more flexible, so that it vibrates more easily.

"A friend showed me some wood from the German forest, a small strip of it planed in 1970, and another one from the same forest that was 200 years old. The new one was stiff as a two-by-four; the old one could bend like a playing card. That's the difference: the old instruments respond more quickly, it's easier to make the sounds," Sturm explained.

In his 93 years, Stradivari produced 1,100 instruments, of which 600 survive. "Stradivari's violins changed around 1700, when his golden period began," Sturm said. "They got much more powerful—here's why." He showed me how the belly of the older instrument arched more in the middle; the newer one was visibly flatter by maybe as much as a half-inch. This flatter shape generally creates a louder tone that can hold its own in modern concert halls. In Stradivari's time, music was played in small chambers, and it was not until the 19th century that music was written for larger orchestras in public theaters. By the 1890s, his violins were in great demand.

Before then, violins made by Austrian Jakob Stainer were more sought after than Stradivari's. The Smithsonian also has an entire string quartet—two violins, a viola and a cello—made by Stainer in the 1600s. They, too, were donated by Herbert Axelrod.

All the instruments get played. Sturm referred me to Kenneth Slowik, professional cellist and artistic director of the Smithsonian Chamber Music Society. Slowik oversees the use of these instruments in the master classes and the chamber concerts on the Mall. Last season Smithsonian groups held 17 concerts, featuring works from Rameau to Bartok.

"But we're careful," Sturm said. "Even if the instruments travel, we use them under controlled circumstances. We have security guards, and humidity and temperature controls."

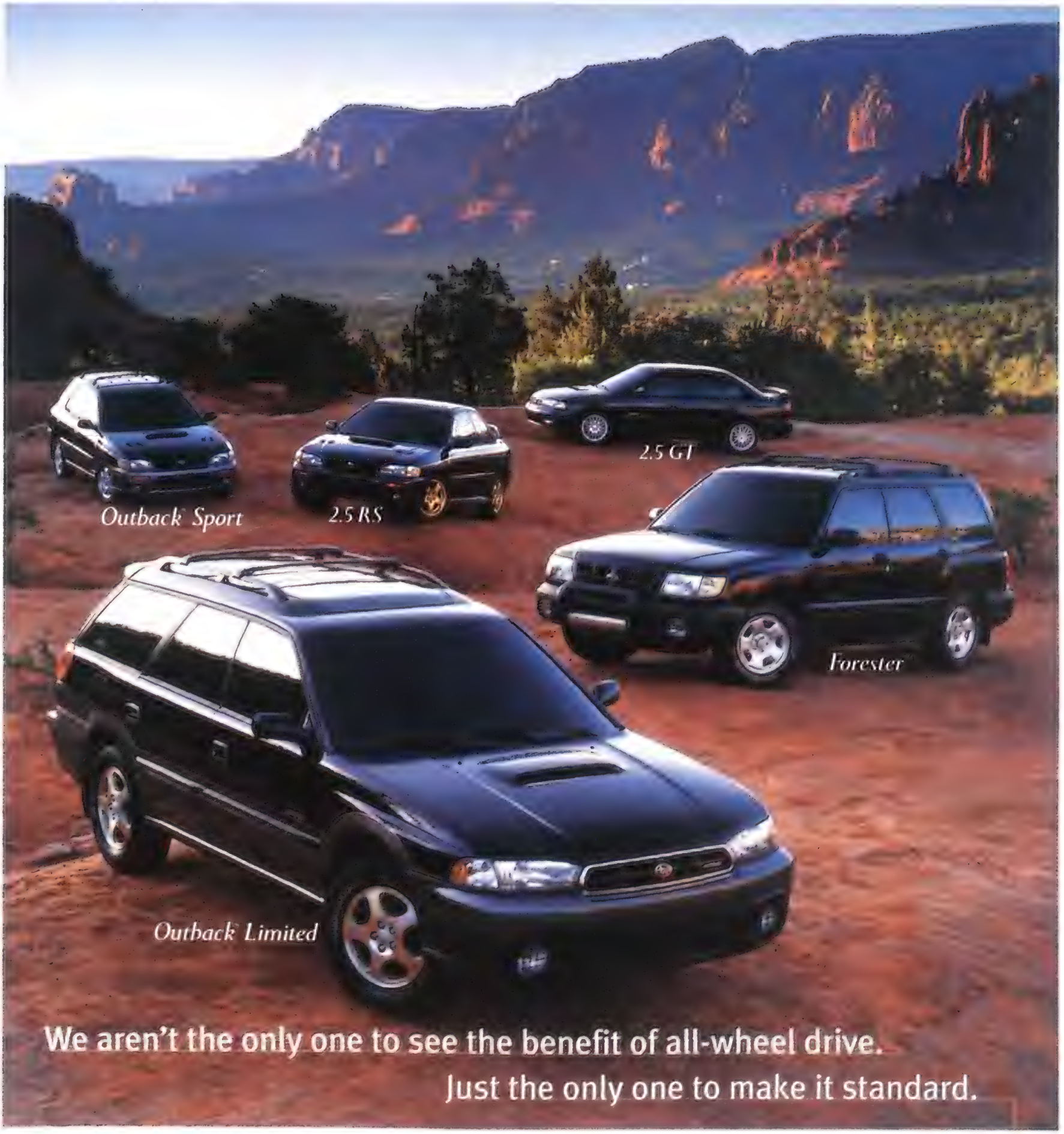
Sturm has never had any disasters with the Strads in his years at the Smithsonian. "These are in amazingly fine condition. Mostly we just keep 'em clean and change the strings."

Appropriately, the Chamber Music Society's quartet, known first as the Smithson, then as the Party of Four, now is officially named the Axelrod Quartet—the same name given to those glorious Strads they get to play.

"I can't tell you," Sturm marveled, "how it feels to play them, the smoothness, the ease with which you can draw out a rich sound. You just don't have to work so hard."

Well now, maybe that was my problem. I played the violin from the age of 4 until I discovered girls, and I practiced for an hour every day, struggled with the high school orchestra, sweated over the annual solo performance, and it was hard work, all right. It was agony every minute, trying to keep it from squeaking, the way a violin will.

Maybe if I'd had a Strad . . .



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THE OBJECT AT HAND

A Wizard's Scribe

BEFORE THE PHONOGRAPH AND LIGHTBULB, THE ELECTRIC PEN HELPED SPELL THE FUTURE FOR THOMAS EDISON

BY BRUCE WATSON

THE OBJECT AT HAND RESEMBLES a fancy eggbeater. Squat and top-heavy, it blends Victorian style with Industrial Age utility. It is Thomas Edison's electric pen. By the time he got around to making it, Edison was 28. He had been granted nearly 100 patents and had spent most of his adult life tinkering with telegraphs.

The pen contained no ink. Powered by two wet cell batteries, it acted more like a sewing machine than a writing implement, punching holes in a piece of paper to make a stencil. Yet in its time, the 1870s, it was the linchpin in the first successful copying process. Its tiny motor, the first commercially marketed electric motor, drove a stylus up and down at 8,000 punctures per minute. To "write," the user simply guided the pen over the paper, which was then set in a frame and inked by a roller.

The electric pen (above, right) cost $30 with batteries and briefly was a fixture in offices.

Though Edison included it in a dream list of inventions, the electric pen has been all but forgotten. Only six are known to survive. This one was acquired by the Smithsonian's National Museum of American History last summer. But before moving on, this moving pen had writ more than its own history. It was the first Thomas Edison device to be mass-produced and mass-marketed. Like a lightbulb filament blazing between connections, it bridged a gap in Edison's life, the gap between the little-known inventor of a better telegraph and the world-famous "Wizard of Menlo Park."

Prior to motorizing a pen, Edison's stock-in-trade had been involved with improving the telegraph. All but a few of his patents were for relay switches, signal boxes, printing telegraphs, and so forth. Western Union loved him, but Edison's creations were hardly needed in every home or office. All over the bustling commercial world, clerks still had to devote whole days to the tedious task of copying ordinary documents. Letters, receipts, bills of sale, were all written by hand, and all needed to be duplicated by hand. If Edison could make his pen turn out hundreds of exact duplicates, he'd have a customer in every office from New York to New Zealand.

"There is more money in this than telegraphy," he wrote to a colleague. "It is to the Country house [scholars think he meant counting house] what sewing machines are to the home circle."

If Edison wasn't yet working in Menlo Park, he was already a wizard who looked the part. A man of average bearing, he was almost always disheveled. His hair, prematurely flecked with gray, hung perpetually over his forehead until he whisked it away. His wide-set eyes seemed to burn with ideas, and because of a pronounced hearing loss, even in a noisy laboratory he could spend hours in meditative silence. In Edison's shop on Ward Street in Newark, New Jersey, he sometimes worked for 60 hours straight, catnapping, snacking at odd moments and exasperating his wife, Mary, by ignoring her nightly demands to come home for dinner. He had better things to do.

Edison's notebook entry on May 31, 1875, lists 19 "experimental topics" on his mind. Among them: "a Method of making 'Malleable iron' out of cast iron," a chimneyless kerosene lamp, a wireless electromagnet and "a copying process that will take 100 copies." Edison had already earned $30,000 by selling tycoon Jay Gould a quadruplex telegraph, able to carry four messages simultaneously over a single wire.

Finding the "copying process" turned out to be fairly easy. Edison had been "struck by the idea of making a stencil of the paper by pricking with a pen." Yet to keep from tearing stencils, a writer had to punch out

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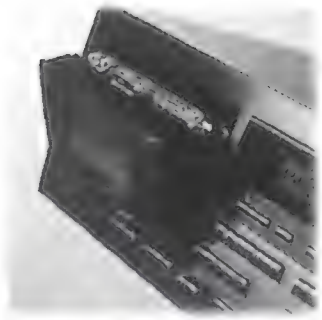

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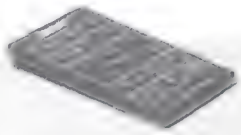

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(rather than scratch) each letter. This proved a time-consuming job until Edison realized a motor would regulate and speed up the process. He had already patented improvements in small motors, so he mounted one on a hollow tube, fitted a sharp stylus

In later years, Edison (here, dictating into an Ediphone, which he also invented) still worked with passionate intensity.

through the tube, then put a flywheel on top and a cam to transform rotating motion into up-and-down thrust. Finally, he wired the motor to two wet cell batteries, ordinary glass jars with zinc and carbon plates steeped in a solution of water and sulfuric acid. Do not try this at home.

The first pen and press, with a hinged frame for holding stencils, was soon finished. Edison found it could work small wonders. The first words etched by the pen were "Now is the winter of our discontent." With the stencil inked, the set printed up 100 perfect copies of the opening soliloquy from *Richard III*. Later, the pen even copied a photograph, tracing over the shape of Mary Edison in a flowing dress.

Moving with startling speed, Edison arranged to have the pen mass-produced. The retail price of $30 included a pen, press, inking roller, ink bottle and battery. Edison advertised in a circular written by the pen itself. The "Electro-Autographic Press," the circular boasted, was "the only process yet invented whereby an unlimited number of impressions can be taken with rapidity from ordinary manuscript." Another ad showed an embracing couple and proclaimed: "Like Kissing—Every Succeeding Impression is as Good as the First—Endorsed By Every One Who Has Tried It!—Only a Gentle Pressure Used." By mid-September, Edison's agents were selling eight pens per day in New York City alone.

In the public mind Edison remains not an inventor so much as an archetype. Self-made—with only three months of formal schooling—he is a living, breathing example of American know-how. In countless school-age biographies, Enterprising Edison peddles papers on a train, then prints his own newspaper from the baggage car. Eccentric Edison sleeps fully clothed on his laboratory floor. Eureka Edison tries hundreds of filaments for his electric light before settling on carbonized cotton thread, which emits a brilliant and lasting glow. These are accurate, if exaggerated, pieces of this puzzling genius. Yet the puzzle can be completed only by Entrepreneurial Edison, whose greatest creation was the inventor as master of mass production and marketing.

In late 1875, Edison decided to leave Newark and build a new laboratory on two tracts of cheap land in central New Jersey. The place was Menlo Park. That winter, as the electric pen found willing buyers, Edison's father supervised the construction of this first research and development lab, with space for a growing cadre of engineers, a place for prototypes to be picked apart for useful pieces, a pipe organ so employees could gather to sing during rare breaks, and shelves stocked with 2,500 bottles of chemicals. In January 1876, Mary gave birth to Thomas Edison, Jr. The inventor quickly nicknamed his son "Dash" to complement daughter Marion, whom Edison called "Dot."

With its patent pending, the "Electric Pen and Duplicating Press" went on display in 1876 at the United States Centennial Exhibition in Philadelphia. By the end of that year, Edison began selling the rights to manufacture and market the pen. One of the eventual buyers was the A.B. Dick Company of Chicago, which turned the print process into the first mimeograph. Within a few years, electric pens were punching out stencils in offices from Washington, D.C. to China. Then, like so many useful inventions before it, the pen was ultimately replaced by a better stencil maker, the typewriter. Edison's elegant little pen was obsolete.

But Edison now was dreaming of a machine that would reproduce human speech. Only a year after licensing the pen, Edison produced the phonograph and became world famous. Two years after, he gave the world light. By 1881, the same Menlo Park factory that had churned out electric pens had been retooled and was making hundreds of electric lightbulbs per day.

Edison kept a prototype of the pen on display in the Menlo Park lab. In 1876 the electric pen system had won a bronze medal at the Centennial Exhibition. As Edison's partner Charles Batchelor told it, the medal was presented to Edison in his New York office one afternoon. Batchelor and Edison then headed home to Menlo Park. Lost in talk about some new experiments, they left the medal on the ferryboat. Batchelor wanted to go back for it, but Edison said, "Don't bother, someone will surely have picked it up." He never mentioned the medal to Batchelor again, his mind already intent on the next wondrous invention.

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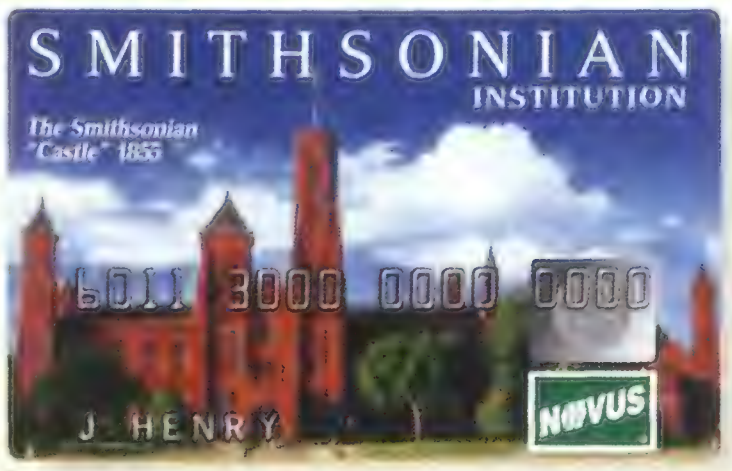

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INDICATION AND USAGE

VIAGRA is indicated for the treatment of erectile dysfunction. The studies that established benefit demonstrated improvements in success rates for sexual intercourse compared with placebo.

CONTRAINDICATIONS

Use of VIAGRA is contraindicated in patients with a known hypersensitivity to any component of the tablet. Consistent with its known effects on the nitric oxide/cGMP pathway (see CLINICAL PHARMACOLOGY), **VIAGRA was shown to potentiate the hypotensive effects of nitrates, and its administration to patients who are concurrently using organic nitrates in any form is therefore contraindicated.**

PRECAUTIONS

General

A thorough medical history and physical examination should be undertaken to diagnose erectile dysfunction, determine potential underlying causes, and identify appropriate treatment.

There is a degree of cardiac risk associated with sexual activity; therefore, physicians may wish to consider the cardiovascular status of their patients prior to initiating any treatment for erectile dysfunction.

Agents for the treatment of erectile dysfunction should be used with caution in patients with anatomical deformation of the penis (such as angulation, cavernosal fibrosis or Peyronie's disease), or in patients who have conditions which may predispose them to priapism (such as sickle cell anemia, multiple myeloma, or leukemia).

The safety and efficacy of combinations of VIAGRA with other treatments for erectile dysfunction have not been studied. Therefore, the use of such combinations is not recommended.

VIAGRA has no effect on bleeding time when taken alone or with aspirin. *In vitro* studies with human platelets indicate that sildenafil potentiates the antiaggregatory effect of sodium nitroprusside (a nitric oxide donor). There is no safety information on the administration of VIAGRA to patients with bleeding disorders or active peptic ulceration. Therefore, VIAGRA should be administered with caution to these patients.

A minority of patients with the inherited condition retinitis pigmentosa have genetic disorders of retinal phosphodiesterases. There is no safety information on the administration of VIAGRA to patients with retinitis pigmentosa. Therefore, VIAGRA should be administered with caution to these patients.

Information for Patients

Physicians should discuss with patients the contraindication of VIAGRA with concurrent organic nitrates.

The use of VIAGRA offers no protection against sexually transmitted diseases. Counseling of patients about the protective measures necessary to guard against sexually transmitted diseases, including the Human Immunodeficiency Virus (HIV), may be considered.

Drug Interactions

Effects of Other Drugs on VIAGRA

***In vitro* studies:** Sildenafil metabolism is principally mediated by the cytochrome P450 (CYP) isoforms 3A4 (major route) and 2C9 (minor route). Therefore, inhibitors of these isoenzymes may reduce sildenafil clearance.

***In vivo* studies:** Cimetidine (800 mg), a non-specific CYP inhibitor, caused a 56% increase in plasma sildenafil concentrations when co-administered with VIAGRA (50 mg) to healthy volunteers.

When a single 100 mg dose of VIAGRA was administered with erythromycin, a specific CYP3A4 inhibitor, at steady state (500 mg bid for 5 days), there was a 182% increase in sildenafil systemic exposure (AUC). Stronger CYP3A4 inhibitors such as ketoconazole, itraconazole or mibefradil would be expected to have still greater effects, and population data from patients in clinical trials did indicate a reduction in sildenafil clearance when it was co-administered with CYP3A4 inhibitors (such as ketoconazole, erythromycin, or cimetidine). It can be expected that concomitant administration of CYP3A4 inducers, such as rifampin, will decrease plasma levels of sildenafil.

Single doses of antacid (magnesium hydroxide/aluminum hydroxide) did not affect the bioavailability of VIAGRA.

Pharmacokinetic data from patients in clinical trials showed no effect on sildenafil pharmacokinetics of CYP2C9 inhibitors (such as tolbutamide, warfarin), CYP2D6 inhibitors (such as selective serotonin reuptake inhibitors, tricyclic antidepressants), thiazide and related diuretics, ACE inhibitors, and calcium channel blockers. The AUC of the active metabolite, N-desmethyl sildenafil, was increased 62% by loop and potassium-sparing diuretics and 102% by non-specific beta-blockers. These effects on the metabolite are not expected to be of clinical consequence.

Effects of VIAGRA on Other Drugs

***In vitro* studies:** Sildenafil is a weak inhibitor of the cytochrome P450 isoforms 1A2, 2C9, 2C19, 2D6, 2E1 and 3A4 (IC50 >150 μM). Given sildenafil peak plasma concentrations of approximately 1 μM after recommended doses, it is unlikely that VIAGRA will alter the clearance of substrates of these isoenzymes.

***In vivo* studies:** No significant interactions were shown with tolbutamide (250 mg) or warfarin (40 mg), both of which are metabolized by CYP2C9.

VIAGRA (50 mg) did not potentiate the increase in bleeding time caused by aspirin (150 mg).

VIAGRA (50 mg) did not potentiate the hypotensive effect of alcohol in healthy volunteers with mean maximum blood alcohol levels of 0.08%.

No interaction was seen when VIAGRA (100 mg) was co-administered with amlodipine in hypertensive patients. The mean additional reduction on supine blood pressure (systolic, 8 mmHg; diastolic, 7 mmHg) was of a similar magnitude to that seen when VIAGRA was administered alone to healthy volunteers (see CLINICAL PHARMACOLOGY).

Analysis of the safety database showed no difference in the side effect profile in patients taking VIAGRA with and without anti-hypertensive medication.

Carcinogenesis, Mutagenesis, Impairment of Fertility

Sildenafil was not carcinogenic when administered to rats for 24 months at a dose resulting in total systemic drug exposure (AUCs) for unbound sildenafil and its major metabolite of 29- and 42-times, for male and female rats, respectively, the exposures observed in human males given the Maximum Recommended Human Dose (MRHD) of 100 mg. Sildenafil was not carcinogenic when administered to mice for 18-21 months at dosages up to the Maximum Tolerated Dose (MTD) of 10 mg/kg/day, approximately 0.6 times the MRHD on a mg/m² basis.

Sildenafil was negative in *in vitro* bacterial and Chinese hamster ovary cell assays to detect mutagenicity, and *in vitro* human lymphocytes and *in vivo* mouse micronucleus assays to detect clastogenicity.

There was no impairment of fertility in rats given sildenafil up to 60 mg/kg/day for 36 days to females and 102 days to males, a dose producing an AUC value of more than 25 times the human male AUC.

There was no effect on sperm motility or morphology after single 100 mg oral doses of VIAGRA in healthy volunteers.

Pregnancy, Nursing Mothers and Pediatric Use

VIAGRA is not indicated for use in newborns, children, or women.

Pregnancy Category B. No evidence of teratogenicity, embryotoxicity or fetotoxicity was observed in rats and rabbits which received up to 200 mg/kg/day during organogenesis. These doses represent, respectively, about 20 and 40 times the MRHD on a mg/m² basis in a 50 kg subject. In the rat pre- and postnatal development study, the no observed adverse effect dose was 30 mg/kg/day given for 36 days. In non-pregnant rats the AUC at this dose was about 20 times human AUC. There are no adequate and well-controlled studies of sildenafil in pregnant women.

ADVERSE REACTIONS

VIAGRA was administered to over 3700 patients (aged 19-87 years) during clinical trials worldwide. Over 550 patients were treated for longer than one year.

In placebo-controlled clinical studies, the discontinuation rate due to adverse events for VIAGRA (2.5%) was not significantly different from placebo (2.3%). The adverse events were generally transient and mild to moderate in nature.

In trials of all designs, adverse events reported by patients receiving VIAGRA were generally similar. In fixed-dose studies, the incidence of some adverse events increased with dose. The nature of the adverse events in flexible-dose studies, which more closely reflect the recommended dosage regimen, was similar to that for fixed-dose studies.

When VIAGRA was taken as recommended (on an as-needed basis) in flexible-dose, placebo-controlled clinical trials the following adverse events were reported:

TABLE 1. ADVERSE EVENTS REPORTED BY ≥2% OF PATIENTS TREATED WITH VIAGRA AND MORE FREQUENT ON DRUG THAN PLACEBO IN PRN FLEXIBLE-DOSE PHASE II/III STUDIES

Adverse Event	Percentage of Patients Reporting Event	
	VIAGRA N=734	PLACEBO N=725
Headache	16%	4%
Flushing	10%	1%
Dyspepsia	7%	2%
Nasal Congestion	4%	2%
Urinary Tract Infection	3%	2%
Abnormal Vision*	3%	0%
Diarrhea	3%	1%
Dizziness	2%	1%
Rash	2%	1%

*Abnormal Vision: Mild and transient, predominantly color tinge to vision, but also increased sensitivity to light or blurred vision. In these studies, only one patient discontinued due to abnormal vision.

Other adverse reactions occurred at a rate of >2%,but equally common on placebo: respiratory tract infection, back pain, flu syndrome, and arthralgia.

In fixed-dose studies, dyspepsia (17%) and abnormal vision (11%) were more common at 100 mg than at lower doses. At doses above the recommended dose range, adverse events were similar to those detailed above but generally were reported more frequently.

No cases of priapism were reported.

The following events occurred in < 2% of patients in controlled clinical trials; a causal relationship to VIAGRA is uncertain. Reported events include those with a plausible relation to drug use; omitted are minor events and reports too imprecise to be meaningful:

Body as a whole: face edema, photosensitivity reaction, shock, asthenia, pain, chills, accidental fall, abdominal pain, allergic reaction, chest pain, accidental injury.

Cardiovascular: angina pectoris, AV block, migraine, syncope, tachycardia, palpitation, hypotension, postural hypotension, myocardial ischemia, cerebral thrombosis, cardiac arrest, heart failure, abnormal electrocardiogram, cardiomyopathy.

Digestive: vomiting, glossitis, colitis, dysphagia, gastritis, gastroenteritis, esophagitis, stomatitis, dry mouth, liver function tests abnormal, rectal hemorrhage, gingivitis.

Hemic and Lymphatic: anemia and leukopenia.

Metabolic and Nutritional: thirst, edema, gout, unstable diabetes, hyperglycemia, peripheral edema, hyperuricemia, hypoglycemic reaction, hypernatremia.

Musculoskeletal: arthritis, arthrosis, myalgia, tendon rupture, tenosynovitis, bone pain, myasthenia, synovitis.

Nervous: ataxia, hypertonia, neuralgia, neuropathy, paresthesia, tremor, vertigo, depression, insomnia, somnolence, abnormal dreams, reflexes decreased, hypesthesia.

Respiratory: asthma, dyspnea, laryngitis, pharyngitis, sinusitis, bronchitis, sputum increased, cough increased.

Skin and appendages: urticaria, herpes simplex, pruritus, sweating, skin ulcer, contact dermatitis, exfoliative dermatitis.

Special senses: mydriasis, conjunctivitis, photophobia, tinnitus, eye pain, deafness, ear pain, eye hemorrhage, cataract, dry eyes.

Urogenital: cystitis, nocturia, urinary frequency, breast enlargement, urinary incontinence, abnormal ejaculation, genital edema and anorgasmia.

OVERDOSAGE

In studies with healthy volunteers of single doses up to 800 mg, adverse events were similar to those seen at lower doses but incidence rates were increased.

In cases of overdose, standard supportive measures should be adopted as required. Renal dialysis is not expected to accelerate clearance as sildenafil is highly bound to plasma proteins and it is not eliminated in the urine.

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Blue, Blue, Blue Guitars

"WE CONSIDERED PURPLE AND EVEN RED," says Scott Chinery, owner of 1,000-plus guitars, the world's biggest and best such collection. "But blue was the perfect color to jolt people out of the old, staid way of looking at the archtop." Archtops, you see, look, well, hokey. They're fashioned after the centuries-old design of violins—the top is arched for better tonality. The first archtop was patented in 1898. To honor the centennial, Chinery commissioned 21 master luthiers to craft 22 blue archtop guitars. Twelve are pictured above; ten more can be seen at smithsonianmag.si.edu. All are on display at the National Museum of American History through October 1. Hokey? "Not at all," says Ravi, a guitarist with Hanson, the planet's top teen heartthrob group, who has played several "They're very cool." —*Bruce Hathaway*

SMITHSONIAN

HIGHLIGHTS

SMITHSONIAN

HIGHLIGHTS

Art Night on the Mall

Enjoy extended summer hours and special films, lectures and gallery tours at the National Museum of African Art, the Freer and Arthur M. Sackler galleries, and the Hirshhorn Museum, Thursday evenings until 8 P.M., through September 3. The Ripley Center's International Gallery, the Hirshhorn's Full Circle Café and the museum shops will also be open.

Magazine Website

SMITHSONIANMAG.SI.EDU

Another place to start finding out about the many exhibitions, events, publications and activities of the Smithsonian is smithsonianmag.si.edu. There you'll find a version of the *Highlights Calendar* with links to the many pages of the Smithsonian Institution Website.

NATIONAL MUSEUM OF AFRICAN ART

African Design and the Furniture of Pierre Legrain (August 16 through November 29) Explores the influence of African chairs and stools on the work of French Art Deco designer Pierre Legrain.
Olowe of Ise: A Yoruba Sculptor to Kings (through September 7) Presents 35 major carvings.
Images of Power and Identity More than 100 works from the collection.
The Art of the Personal Object Features utilitarian objects from Africa and celebrates their aesthetic values.
The Ancient West African City of Benin, A.D. 1300-1897 Features the museum's collection from the royal court of the capital of the kingdom of Benin as it existed before British colonial rule.
The Ancient Nubian City of Kerma, 2500-1500 B.C. Features 40 works—from the permanent collection of the Museum of Fine Arts, Boston—that celebrate Kerma, the capital of the kingdom known to the Egyptians as Kush.
Sokari Douglas Camp: Three Sculptures Sculptures by the Nigerian artist Sokari Douglas Camp (b. 1958) are featured in the museum's pavilion. Two sculptures are kinetic and are timed to perform at 15 and 45 minutes past the hour during museum hours.

NATIONAL PORTRAIT GALLERY

Recent Acquisitions (August 8 through January 24) Paintings, sculptures, prints and photographs by such artists as Henry Inman, Elaine de Kooning and Jamie Wyeth, a self-portrait by Jacob Lawrence and two photographs of Marilyn Monroe by David Geary, taken when the star visited Korea in 1954.
Celebrity Caricature in America (through August 23) More than 200 caricatures of the stars of stage and screen, sports heroes and colorful personalities, both famous and infamous, who fascinated America between the world wars.

NATIONAL POSTAL MUSEUM
[NEAR UNION STATION ON CAPITOL HILL]

The Artful Mailbox (through May 1999) A whimsical, handcrafted mailbox.
Artistic License: The Duck Stamp Story Fifty new objects.
What's in the Mail for You! Innovative, hands-on exhibition about the direct mail industry.

COOPER-HEWITT, NATIONAL DESIGN MUSEUM
[NEW YORK CITY]

Fountains: Splash and Spectacle (through October 11) Inventive designs dating from the Renaissance to the present. See SMITHSONIAN, June 1998.
Under the Sun: An Outdoor Exhibition of Light (through October 25) The power of the sun as a catalyst for design, featuring solar and solar-electric products, prototypes, commissioned designs—from sundials to solar collectors and more. See www.si.edu/ndm.

NATIONAL MUSEUM OF AMERICAN ART

David Hockney's Grand Canyon (through September 7) Panoramic oil painting, 24 feet wide, made up of 60 individual canvases, along with six related works.
Stuart Davis (through September 7) Fifty-six paintings by one of America's finest modernists.

Planning a Smithsonian Visit?

THE CASTLE—INFORMATION CENTER

Begin your visit at the Smithsonian Information Center's Associates' Reception Desk—open 9 A.M. - 4 P.M. daily—in the Castle. Special materials and information on exhibitions, activities and dining await you there. Learn what's new at the Smithsonian and other capital attractions—videos, touch screens, maps and more. Smithsonian museums are generally open 10 A.M. - 5:30 P.M. daily, except December 25. Summer hours at the National Zoo are 10 A.M. - 6 P.M. daily for buildings, and 6 A.M. - 8 P.M. for grounds.

Receive a free Associates' planning packet. Write Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560, or call 202-357-2700 (voice) or 202-357-1729 (TTY), 9 A.M. - 5 P.M., Monday-Friday; 10 A.M. - 4 P.M., Saturday-Sunday. *Note:* Parking is limited; Metrorail (subway) is convenient to all museums.

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FREER GALLERY OF ART

Japanese Art in the Age of Koetsu (through February 5, 1999) Cultural renaissance of early 17th-century Kyoto.
Charles Lang Freer and Egypt Freer's collection of Egyptian artifacts.
Masterworks of Indian Painting II (through January 10, 1999) From the Mughal dynasty and the Rajput courts.

ARTHUR M. SACKLER GALLERY

Ikat: Splendid Silks from Central Asia (through September 7)
The Buddha's Art of Healing (August 2 through January 3, 1999) Fourteen paintings from an illustrated medical treatise that is considered to be one of the greatest surviving treasures of Tibetan civilization.

HIRSHHORN MUSEUM & SCULPTURE GARDEN

Triumph of the Spirit: Carlos Alfonzo, A Survey (1975-1991) (through September 13) Paintings, works on paper.
The Collection in Context: Henry Moore's Stringed Figure No. 1 (through September 7) The sculptor's 1937 work in cherry wood and string.
Directions—Tony Oursler: Video Dolls with Tracy Leipold (through September 7) Video-animated sculptures.

NATIONAL AIR AND SPACE MUSEUM

Business Wings (through May 31, 1999) The history of business aviation—from biplanes to "bizjets."
Star Wars: The Magic of Myth (through January 31, 1999) For information on limited free same-day passes, call 202-786-2122. Advance tickets can be purchased through ProTix (800-529-2440).

NATIONAL MUSEUM OF AMERICAN HISTORY

A Collector's Vision of Puerto Rico (through January 1999) Items from Teodoro Vidal's 3,200-object collection.
Between a Rock and a Hard Place: A History of American Sweatshops, 1820-Present (through October 30)
American Encounters Cultures of New Mexico's Upper Rio Grande Valley.
Information Age: People, Information and Technology A 150-year history.

NATIONAL MUSEUM OF NATURAL HISTORY

Janet Annenberg Hooker Hall of Geology, Gems and Minerals Spectacular new gallery showcases the National Gem Collection and takes visitors from the depths of a copper mine to the far reaches of the Solar System.
Natural Selections: Museum Photography by Chip Clark (through September 7) On exhibit are 33 large-scale prints, selected from the photographer's 25-year career at the National Museum of Natural History.
Exploring Marine Ecosystems Tropical coral reef and temperate rocky shore reef.
In Search of Giant Squids The world's largest invertebrates.

NATIONAL ZOOLOGICAL PARK

The Birds of Paradise Lost The distinctive birdlife of the Hawaiian Islands.
Amazonia The world's largest rain forest and river habitat.
Pollinarium Means of reproduction—living plants, hummingbirds, butterflies and a colony of bees.
Think Tank The biology and evolution of animal thinking with a focus on orangutans.

ARTS AND INDUSTRIES BUILDING

Speak to My Heart: African American Communities of Faith and Contemporary Society The role of the black church.
Resonant Forms: Contemporary Women Sculptors (through September 30)
Three Generations of African American Women Sculptors (through September 30)
Discovery Theater Live theater for young audiences. For information, call 202-357-1500 (voice or TTY) weekdays, 8 A.M. - 4 P.M.

ANACOSTIA MUSEUM

Man Made: African American Men and Quilting Traditions (through September 7)
Muhammad Ali: A Thirty-Year Journey (through September 7) Photographs.

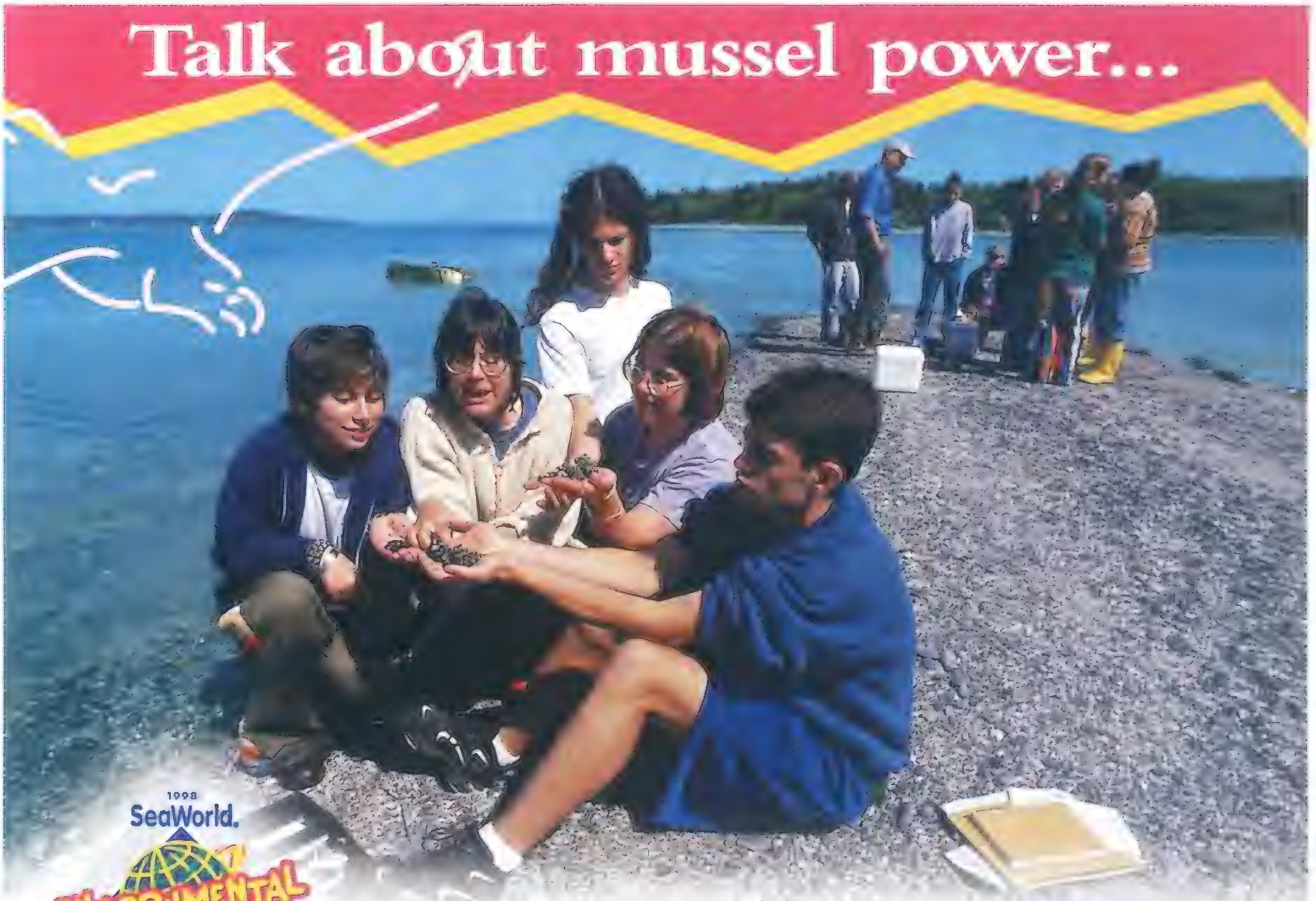
A Joyride with American Names (co-sponsored with Merriam Webster) August 11, 6 P.M.
Firepower! Jose Greco II Flamenco Dance Company August 19, 7:30 P.M.
For tickets, call 202-357-3030. For information on other Associates programs, visit www.si.edu/tsa.

Catalogues currently available include:
Posters American Style ($35 cloth, $29.95 paper)
The Jewels of Lalique ($50 cloth, $37.50 paper)
Celebrity Caricature in America ($45 cloth)
Three Generations of African American Women Sculptors ($24.95 paper)
Indian Humor ($20 paper)
Stuart Davis ($35 paper)
Faces of Time: 75 Years of Time Magazine Cover Portraits ($40 cloth)
To order, send check or money order to Smithsonian Museum Shops, 8308 Cinder Bed Road, Lorton, Virginia 22079. Include 15 percent of purchase for shipping (minimum $4.50).

Visit the Smithsonian Productions Website for information about their radio programs and video products: www.si.edu/sp. Currently being broadcast is "Jazz Smithsonian," featuring classic American jazz, with host Lena Horne and the Smithsonian Jazz Masterworks Orchestra, which performs music of the 1920s through the 1960s. Check public radio listings in your area.

SITES organizes and circulates exhibitions to cities throughout the United States and abroad. To sponsor a show in your community, write to: SITES, Smithsonian Institution, Washington, D.C. 20560. A listing of current exhibitions and additional information is available at www.si.edu/sites.

Talk about mussel power...



1998 SeaWorld. Busch Gardens. Environmental Excellence Awards

1998 Grand Prize: "Sophomores for Clean Shores"

While studying mussels, students at Mt. Desert Island High School in Mt. Desert, Maine, knew their local bay, once famous for shellfish harvesting, was in trouble. By redesigning sewage pipes, monitoring red tide and surveying shorefront residents, "Sophomores for Clean Shores" have reopened clam and mussel flats previously closed for decades. The "SeaWorld/Busch Gardens Environmental Excellence Awards" salute teachers and students like "Sophomores for Clean Shores." Since 1992, more than a half million dollars has been awarded to students who are working to protect and preserve the environment. Whether they're saving a threatened habitat, cleaning up a community, protecting an endangered species, exploring alternative energy or speaking on Capitol Hill, these students are hard at work for planet Earth.

As just one part of the parks' 40-year commitment to animal rescue and rehabilitation, conservation, education and research, this program is helping the nation's classrooms, from the shores of Maine to the California coast, make a difference.

To find out how your school group can enter the 1999 "SeaWorld Busch Gardens Environmental Excellence Awards," **call (407)363-2389 for a free brochure or visit www.seaworld.org or www.buschgardens.org** where you can learn more about the environmental adventures of SeaWorld and Busch Gardens.

SeaWorld ADVENTURE PARKS

BUSCH GARDENS

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From: Larry Stopczynski

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Oh, My Aching

AT THE UNIVERSITY OF VERMONT, SCIENTISTS WORK TO PINPOINT THE SOURCE OF YOUR **PAIN**

BY RICHARD WOLKOMIR
PHOTOGRAPHS BY RICHARD SCHULTZ

THIS IS EMBARRASSING. MY "Virtual Corset" is vibrating. It is a gadget the size of a deck of cards that I wear under my sweater, harnessed to my chest. It is recording my torso's movements for science. But the bioengineers also set it to buzz a warning whenever I bend over more than 25 degrees. That is because bending hurts my achy back.

Back pain has brought me to the Vermont Back Research Center, at the University of Vermont. I want to learn why my back hurts if I sit too long or if I lift grocery bags from my car's trunk. And why does nobody seem able to fix an aching back like mine? Jotting notes as I talk to the researchers, I hunch over my pad. It is a bad habit. *Buzzzz!* There goes my Virtual Corset again.

My lumbar outbursts began 20 years ago, when I helped my wife rearrange her office. Feeling young and strong and showing off a little, I hefted her desk and felt a twinge in the small of my back. Ever since, it hurts periodically.

I try not to whine about it. For one thing, my father's work required muscling hot-air furnaces off his pickup truck and carrying barrels of tar onto roofs. He spent many evenings supine on the floor, easing his throbbing back, kidding about it. He was worse off. Also, I am not alone. In the developed world, at least 80 percent of us eventually get back pain.

The Vermont Back Research Center is a good place to learn about sore backs. It is the only U.S. research center funded solely to probe out-of-whack lower backs. Also, its primary funding agency, the National Institute on Disability and Rehabilitation Research, insists on practicality. The Center's researchers do generate scientific papers, but they also produce usable gear, like my Virtual Corset.

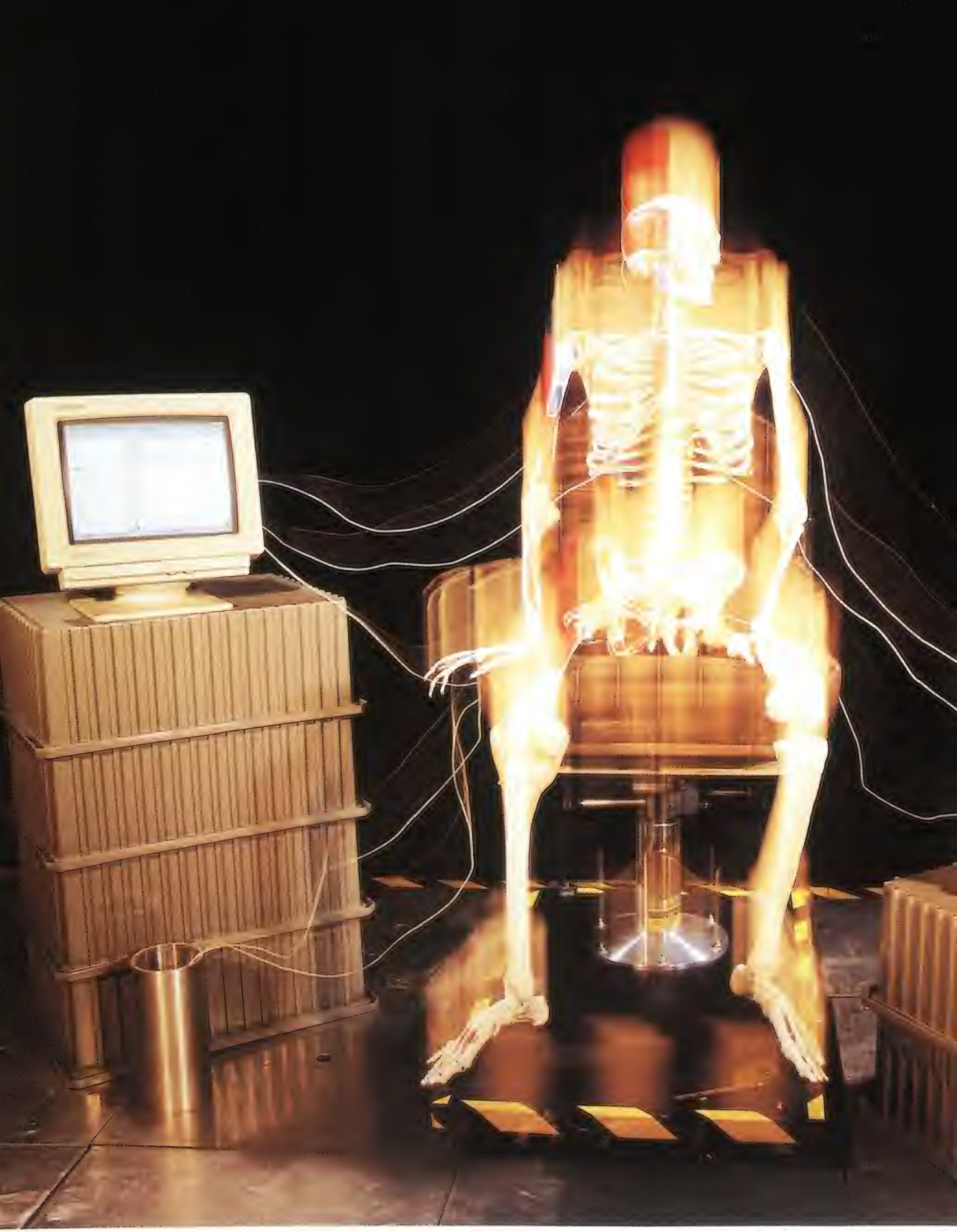
"We want to see if it works better than a traditional corset," James Fox, one of the center's engineers, tells me. Sometimes physicians fit back-pain sufferers with an around-the-midsection elastic corset, to inhibit excessive bending. An electronic Virtual Corset would be less bothersome. Also, the gadgets can monitor how your torso moves through the day, then regurgitate the data for your physician.

"Remember, your doctor never sees you moving in normal life, and you may make movements that you don't even notice yourself," Fox tells me, as I unstrap my Virtual Corset. He downloads the unit's data into a computer and prints out bar graphs that show how I've been moving today.

"You spent 24.3 percent of the day bent over at more than 25 degrees," Fox says, peering at my graphs. A center physician, listening in, admonishes, "Not good!" Fox says, "I can also supply your average trunk angle, by the hour, if you'd like."

He has been testing the prototype Virtual Corset on backache patients, from landscapers to desk workers. "Our next design will be a lot small-

For researchers, the human vertebrae, intricate and problem prone, present many unanswered questions.



er, and right now we record flexion and lateral bending, but we'll add twisting," he says.

Even armed with Virtual Corsets, physicians face medicine's version of the search for the charmed quark. MRI studies show that at least 20 percent of the population have herniated disks and other spine abnormalities, yet feel zero pain. But MRIs of back-pain sufferers, including mine, mostly show no discernible abnormalities at all. And calls to the center's information line can seem to emanate from the Twilight Zone.

"I'm way too flexible," announces a caller who has been diagnosed with a syndrome called joint hypermobility. "Are contortionists born with the same condition?" Center librarian Rebecca Mueller gives her information on joint hypermobility and associated risk for back injury.

I put my own question, in person, to the center's director, orthopedic surgeon Martin Krag: Why do physicians seem unable to do much about aching backs? Looking a bit pensive, he tells me: "Bend over to lift a pail of water the compressive force between your bottom two vertebrae is nearly a ton!"

Dr. Krag is 6 feet 4 inches tall. I wonder if he is sad imagining the forces vectoring down his own elongated spine as he bends over an anesthetized patient, scalpel poised. But his melancholy turns out to be medical angst: even nearing the 21st century, to treat an achy back is to venture off the diagnostic map into fog.

"With that ton of force, if your brain screws up just a little and you contract your back muscles in the wrong sequence, you start snapping cables," Dr. Krag says.

But which "cables"? As Dr. Krag puts it, "We know more about the inner workings of molecules than about what happens to your back when you bend over to tie your shoes." He plunks a life-size model of the human spine onto the table and contemplates it. Finally, he mutters, "I'm amazed we don't all have back pain all the time!"

He runs a finger down this buckle-prone column: seven cervical vertebrae at the top, 12 thoracic vertebrae attached to the ribs to form the chest, and then, at the small of the back, where it gracefully curves, five big lumbar vertebrae. The spine's base broadens into the sacrum, five fused vertebrae that transmit the body's weight to the hip joints. At its nether tip, the spine peters out into the useless coccyx, the evolutionary remnant of our primordial tail.

Our vertebrae, Dr. Krag tells me, are made of the stuff of seashells: calcium carbonate and calcium phosphate. Yet they are alive, full of blood, with cells endlessly repairing cracks. At its back, each vertebra blossoms with spines and knobs. Muscles attach to these "processes," and so do ligaments. "Think of ligaments as packing tape, with thin threads running through it," Dr. Krag says. Ligaments run like ribbons down the spinal processes, acting as check reins: bend too far and they stop your spine from curling over.

Veins and arteries snake up the spine. The spinal cord runs down the vertebrae, through a bony tunnel. Nerve roots sprout from the spinal cord, poke out openings in the vertebrae, then spread through the body.

Studying a live person's spine is hard. "The anatomy is incredibly complex," Dr. Krag observes. Also, the muscles controlling the spine's movement are in layers. It is hard to know which layer is contracting.

"We each have our own signature, a certain pattern in the way our spine

A skeleton replica, wired to a device that simulates the vibration of a moving vehicle, transmits data for computer analysis.

muscles and bones contract and move," Dr. Krag says. "But if you look at the fine details of the movement of each person's spine, it's the same over and over again, which means the brain's ability to control the movement is exquisite."

It must be. If a muscle contracts out of sequence, forces on your spine become unbalanced. Muscles or tendons may overload. "I think that's a major component of low back pain," says Dr. Krag.

Now the center is planning a long-term study of how muscles control the vertebrae. "Muscle functioning is an important frontier," says Dr. Krag. "We know precious little about what can go wrong with muscles, and even less about what to do about it."

Another information line call, this time from a Pennsylvania policewoman. "I wear belts around my hips, and it's really heavy on my gun side. Is that why my back's hurting?"

Rebecca Mueller: "Mailbags carried on one side can hurt postal workers' backs." She asks, "Do you sit a lot in your patrol car? That could cause problems. Especially if the car vibrates a lot."

Wearing the Virtual Corset, a landscaper records data on his spine-stressing activities.

I am in a laboratory at the research center. Taped to the small of my back I wear an electrified stainless-steel strip lined on both sides with electronic gauges that measure strain.

"Why don't you first arch your back, and then hump your back?" suggests engineer Roberto Khatchadourian. He is eyeing a computer screen. The strip on my back is wired to the computer. It can sense how far my spine curves in either direction.

"We call this a Lordosimeter, from 'lordosis,' the curvature of your lower back," Khatchadourian says, punching computer keys. "The opposite of lordosis is kyphosis, a convex curve of the spine, like when you lift something, and one theory is that kyphosis is detrimental."

Trailing wires, I arch my back. "A number on the screen is telling me your specific lordotic posture," Khatchadourian says. "Now hump up." I pretend to pick up a penny off the floor. "You went into kyphosis for about two and a half seconds, and then returned to lordosis," Khatchadourian says, studying his computer screen.

Researchers invented the Lordosimeter to evaluate how sitting posture affects pressure on the spine's disks. But they are now developing this device to help patients with spinal stenosis. It typically afflicts people in their 60s or 70s. Their aging vertebrae's bony protuberances enlarge, pressuring nerve roots and constricting tiny blood vessels accompanying the nerves, triggering back pain. Spinal stenosis patients are testing whether the Lordosimeter can teach them to flatten their lower back as they stand, reducing pressure on the nerves.

In another of the laboratories, I try the Liftbox. It will reveal how I lift a heavy object. In its prototype incarnation, the Liftbox is a cardboard carton containing 16 pounds of plywood frame and an accelerometer. Wires snake to a computer. When someone lifts the Liftbox, the accelerometer relays the box's velocity changes to the computer.

The Liftbox may emerge as a standard tool in factories and warehouses. Workers will lift it to see if they need training in how to lift properly, so as to avert back problems. Also, a medical company hopes to make the Liftbox into a tool clinicians can use to

At the Spine Institute, a back-pain sufferer learns biofeedback techniques.

classify backache patients' conditions.

First, however, Liftboxes must function as research tools to determine the safest lifting techniques. The standard advice still applies: to lift something heavy, start from a crouch, letting your leg muscles take the weight, and hold the object close to your torso, tightening your abdominal muscles. If you ignore that bit of physiological good sense, you risk strained back muscles. But experimental verification is pending, along with data on safe lifting's fine points, which is where the Liftbox comes in.

That is because nobody is yet sure which lifting styles hurt backs, explains Dryver Huston, who is chair of the university's mechanical engineering department. He also oversees much of the Back Research Center's device research, and he is looking on as I prepare to lift the Liftbox.

I heft the box from a pallet, twist left, and put it onto a chest-high shelf. I try two more lifts. Then Roberto Khatchadourian lifts the box three times, too, to get a contrasting pattern.

"Nobody really knows the rules for safe lifting—that's what we're trying to figure out," engineer Rob Church says, as his computer produces graphs. My graph shows I lifted the box smoothly, without bursts of acceleration. Khatchadourian's graphs show two high peaks at each lift's start, indicating acceleration bursts.

"Force is proportional to acceleration, so a peak equals higher spinal loads, and higher loads are more dangerous, in theory," says Dryver Huston. So I lifted well, and Roberto did not. But then I remember: I'm the one with the aching back.

"We want to see if lifting patterns predict injury," says Church. If they do, the lab will team up with a corporation, testing the Liftbox on employees to refine it for the workplace. "Maybe, if you lift wrong, it will beep," says Church.

I have been leery of one machine: "The Shaker"—a truck seat mounted atop a massive hydraulic mechanism hidden under the laboratory's floor. The piston is pushed by 2,000 pounds of pressure per square inch, shaking the chair up and down or from side to side, as hard as the operators wish. The Shaker can mimic the vibrations of any vehicle, from a delivery van to a helicopter. It tests the impact of vibration and jolting on the spine.

"In industry, they use shakers to test things from laboratory vials to railroad cars; and automobile companies have shakers, too, but they don't like to test people, for liability reasons," Huston says. "We have one of the few shakers in the country that is safety approved for humans."

That would be me. I am enthroned on the truck seat and wired. I sit on an accelerometer, to measure the vibrations going into me, and another is taped to my chest, to measure how much those vibrations are absorbed by my spine, possibly doing damage. The usual wires slither off to the usual computer.

"We've recorded the vibration patterns of vehicles like tractor-trailer trucks, surface-mining trucks, and buses, and the computer can set the chair vibrating to their patterns," Huston says. Drivers of such vehicles, he explains, have four times the normal incidence of herniated disks and twice the chronic back pain. "One hypothesis is that shaking beats up the back and muscles. But posture

"I'm eight and a half months pregnant, and I have horrible lower back pain. Can you help?"

and lifestyles may be factors, too."

For me, the chair is programmed to emulate a truck. "Modern truck suspensions don't beat you up so much—the worst vibration is on Navy cigarette boats without computer-controlled seats, and on forklifts and mining trams," says Huston. "It's also bad for helicopter pilots and Navy fighter pilots who are landing on aircraft carriers."

Truck and bus drivers have a high incidence of low back pain. One theory is that the vibration moves spinal disks into unnatural positions and locks in those positions over extended periods of time. But Huston notes that runners experience high vibrational loads without high incidence of back pain. "Do drivers get out of their truck or bus after a long trip, with lots of vibration that has misaligned their spines, and then unload cargo or luggage?" he asks. Two groups with a high incidence of back pain are laborers who lift heavy objects and, oddly enough, office workers, who lift virtually nothing and mostly just sit. Weight lifters, on the other hand, tend to be free of back pain. "Running is a natural posture, and lifting is actually fairly natural, but sitting is unnatural," says Huston.

Now the truck seat rumbles beneath me. Huston is saying that every solid object has a "natural" or "resonant" frequency. For human bodies, this resonant frequency is about 5 Hertz (cycles per second). I'll hit that. He gives me a "kill switch" to push if the ride gets too jouncy.

Now the chair bucks. I feel the vibration in my stomach and the backs of my eyeballs. There are two nasty thumps, as if my truck hit potholes. I try to talk and it sounds like gargling. I feel the fluid in my eyes dancing. The chair's bumping decreases. Now I just feel royally jounced.

When I finally dismount, Huston tells me my ride is part of a study of an air-filled cushion. It is designed to damp vibrations that a vehicle operator would receive full force, through the vehicle's seat. When the computer prints out my graphs, they show the cushion worked for me, softening vibrations. Wheelchair users are one group at whom this study is aimed; the findings should help truckers and equipment operators, too. And the center is now gearing up for a field study of vibration's impact on commercial drivers.

"You rode that chair for ten minutes, but what about three years of driving a bus or truck?" Huston asks. Center engineers have already installed prototype test gear on the driver's seats of local buses. Preliminary data show the drivers are getting lots of vibration, and have lots of back pain.

"I'm eight and a half months pregnant, and I have horrible lower back pain," pleads an information line caller. "Can you help?"

"I'll send you articles right away," says Rebecca Mueller. The materials she sends will explain that pregnancy-induced hormone changes soften and loosen the pelvic joints. Also, a pregnant woman carries 15-30 extra pounds in her lower abdomen, or more if she has gained weight, and her muscles may not be conditioned to carrying so many pounds. In addition, it is an asymmetric load. As the woman's center of gravity changes, her posture also changes, and that may stress her back as well.

To lessen the discomfort, she should be mindful of her posture, and be careful about lifting, relying on her legs rather than her back muscles. She may want to invest in special slings to help support her enlarged abdomen. She also should avoid sudden movements that could cause her to slip, because gyrating to regain her balance could lead to a strained back. Most of those women who develop backaches during pregnancy, however, recover soon after delivery.

My own back pain has flared up, too. It must be from all this note-taking and maybe Liftbox lifting and Shaker jouncing. I visit the Back Research Center's affiliated clinic, the Spine Institute of New England.

"When you're talking about long-standing pain, you're not talking only about body parts," therapy coordinator Sheila Reid tells me.

She means that a hurting back inevitably affects your mind. But while 80 percent of the population in developed societies eventually get backaches, for 90 percent of those sufferers the pain goes away on its own. It is the remaining 10 percent who face real problems. They do not get better, which can lead to anxiety or depression. Many can no longer work.

Clinic patients receive a range of treatments, from injections of anti-inflammatories into the facet joints, where two vertebrae connect, to epidural injections to soothe irritated nerve roots. Many patients are prescribed medications that can reduce swelling, reduce pressure or desensitize nerves. Some sufferers might be fitted with corsets or braces.

Surgery is appropriate for fewer than one in a hundred. But, in certain cases, Dr. Martin Krag might operate. Besides serving as a professor at the University of Vermont College of Medicine and director of the Back Research Center, he is a surgeon at the clinic. Operations, he says, can realign misaligned spinal parts, eliminate motion of painful joints and remove pressure on pinched nerves.

For a small percentage of sufferers, neither surgery nor medication helps. For them the clinic offers an intensive

Only 1 in 100 back-pain sufferers requires surgery. Here, Drs. Martin Krag, right, and Jim Kohut remove vertebrae, easing discomfort.

Dr. Roland Hazard, a backache sufferer, holds a BackCycler, one of the devices he has developed to alleviate back pain.

program, scheduled for eight and a half hours per day, five days a week, for three weeks. The aim is not to cure the pain, although that may happen. Rather, they learn to cope. And so, besides its four physicians and two surgeons, the clinic deploys physical and occupational therapists, psychologists and exercise technicians.

Looking into one noisy room, I see a man grimace with pain as he sticks pegs into a wall-mounted pegboard. A woman lifts a box. Another woman is stacking plastic baskets onto shelves. A man is lugging a computer from spot to spot. It is a room full of clunks and bumps and thuds and the sound of heavy objects sliding across the floor. Here, patients practice on-the-job movements, gritting their teeth against pain as they learn how to keep on working. Therapists help them to adjust their on-the-job movements for their type of back pain and their work. They also learn that they can keep working, to some degree, even if their back is painful. As therapist Sheila Reid puts it, "hurt does not always mean harm."

Many back-pain sufferers fear activity will aggravate their injuries. They do less, lose muscle tone and then feel they can do even less. "It's a downward spiral," says Reid. Exercise may, in fact, temporarily increase their pain, she says. But, in the long run, they are better off.

Down the hall from the room that functions as an ersatz workplace is a gym. "Our intensive people spend at least an hour a day here," Reid says. "We have low-impact aerobics, for instance, because back pain makes people very protective of their spine, so that they move like robots." Some researchers also believe aerobic exercise increases the spine's blood supply.

Psychologists counsel many patients. "People who develop chronic, disabling back pain often start out with underlying problems—they are barely coping, and this pushes them over the edge," says Reid. Patients with limited education may be facing the loss of the only job—albeit a backbreaking one—that pays them well. Some contemplate suicide. Patients may know someone with back pain from cancer and fear that is their own fate

"Don't turn yourself into a pretzel," Reid tells me, as I try stretching exercises. "Don't try to be Rubber Band Man." And don't, she admonishes, hold your breath when you stretch. I immediately resume breathing. She explains that back muscles you want to stretch to ease pain are the same muscles you tighten holding your breath. I am standing straight, with my hands at the small of my back, inhaling deeply, then bending backward while exhaling. My lumbar throb eases.

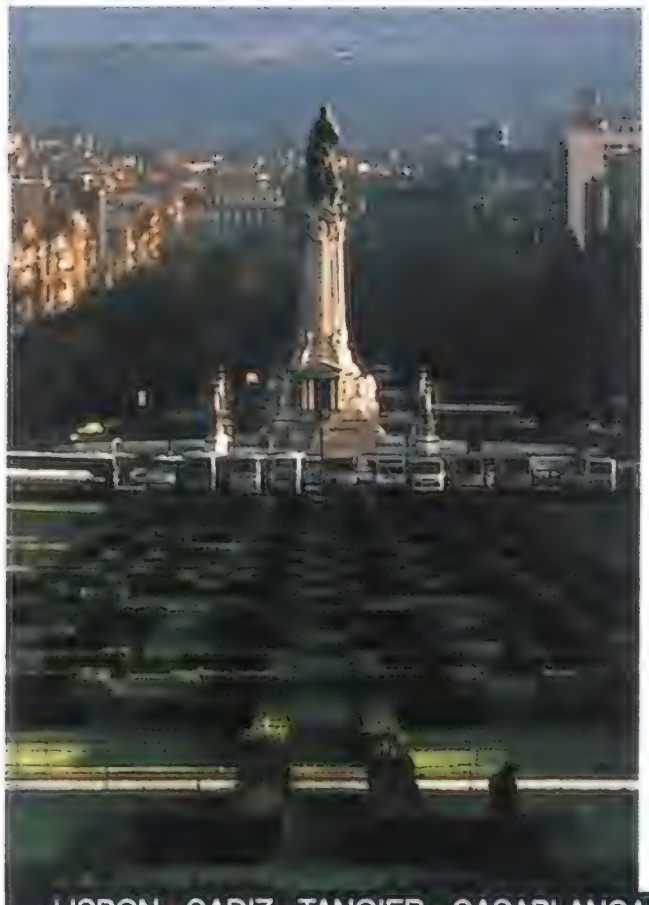
"When I started practicing, the thing was situps, situps, until the cows come home, but our research showed that back-muscle weakness is at least as much the culprit in back pain as stomach-muscle weakness," Reid tells me. It is not that the researchers now pooh-pooh the importance of strong abdominal muscles. In addition to situps and the like, however, the workout menu now includes back-muscle exercises, too. As Reid puts it, "We encourage people to use their back."

My own ache, I suspect, is aggravated by too much sitting at my computer. Back at the research center, I discuss chairs with ergonomics engineer Brian Lowe and biomedical engineer Steven Reinecke. Reinecke, formerly on the center's staff, is a consultant to seat manufacturers. They are working on guidelines to help backache sufferers choose office chairs. But the best antidote may be getting up frequently, especially in our computer-based society, which keeps us sitting. "People with low back pain are hypersensitive to sitting in one place for long periods of time," says Reinecke.

At the center, Reinecke helped develop the BackCycler, along with Rowland Hazard, M.D., one of the center's researchers. It looks like a backrest cushion and is wired to a telephone-size gadget that sits on the floor and can plug into a standard household socket or a car's cigarette lighter.

"Back in 1986, I was driving to Cape Cod in a car with terrible seats," Dr. Hazard tells me. "My back got stiff, and when I put a pillow behind my lower back, it felt better—for about 30 miles." He removed the pillow. His backache went away. Thirty miles farther on, he needed the pillow again. "By the time I got to New Hampshire I realized it was the movement that made me feel better," he says. He seized upon the idea of an in-the-chair gadget that would keep your spine moving as you sat.

Much engineering later, the BackCycler is now on the market. Dr. Hazard and I are visiting the factory, a short drive from the research center. As we watch the assembly line,



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At the Spine Institute of New England, patients perform an array of occupational-therapy exercises.

he tells me, "If my whole life hadn't been about back pain, this would never have occurred to me!"

Dr. Hazard's invention won a first prize from the International Society for the Study of the Lumbar Spine. "United Airlines is now installing BackCyclers big time," he says. A Swedish trucking company is looking into installing BackCyclers for its drivers. Many Bangkok buses now feature BackCyclers to pacify passengers stuck in their seats. As Dr. Hazard explains, "There's lots of traffic there."

I tried the BackCycler. It felt like leaning against a big anaconda as it rhythmically inhaled and exhaled. It did ease the aching. But the machine is now in its tenth year of study at the Back Research Center because nobody yet knows why it works. One theory is that it keeps the lower spine moving as you sit, helping to pump nutrients into the disks. Also, the movement may allow spinal muscles to share the load, so that a few muscles do not become overworked.

An information line call: "I'm with the Royal Canadian Mounted Police, and my back hurts—do you think lots of hours on an all-terrain vehicle could be causing this?"

Rebecca Mueller: "Yes."

"We're wowed by technology," Dr. Hazard tells me, back at the research center. "We assume if we go to a doctor we'll get a precise analysis and a technological fix." But nobody can see your aching back. "If the doctor can't tell you what's wrong, doubts creep in: Am I screwy? A bad person? This kind of ambiguity can destroy your self-confidence and your relationships," says Dr. Hazard.

Early intervention might help. And so Dr. Hazard, with Sheila Reid and others, has developed the "Vermont Disability Prediction Questionnaire," which I am about to respond to.

"How many times have you visited a medical doctor in the past for back problems?" That question seems reasonable. But why do the researchers want to know how many times I have been married? And what does it matter how well I get along with my coworkers? Dr. Hazard shrugs. "We don't know," he says. He does know the answers to such questions have proved predictive. As with so much about backs, the whys remain murky.

A few days later, at home, I get a call from the center, giving me the results of my questionnaire. I scored zero. My bad back's chances of actually disabling me anytime soon are nil.

At the center I learned a few things you can do to prevent back pain: exercise muscles that support the back, keep trim, don't slouch, quit smoking. Signs of a serious back condition include loss of bladder or bowel control, loss of strength or sensation in your legs, feeling sick or feverish with your pain, and pain that steadily worsens over a period of weeks. But most backaches are caused by muscle strains, and they usually fix themselves.

You can help the healing process. For one thing, physicians now say more than a day or two in bed can actually harm your back, by weakening the muscles. Instead, you should slowly, steadily resume normal activities. At first, avoid heavy lifting, repeated bending and twisting, and long periods of sitting still. Try to do a little more each day, back experts advise, even if it hurts. Workouts that include stretching, walking, swimming or weight training can help make your backache go away.

Meanwhile, I may have found a magic cure. So I dial up the center's information line myself.

I tell Rebecca Mueller: "My back was bothering me, but yesterday I chopped up a big fallen tree and moved 250-pound trunk sections, pushing them end-over-end. I thought I'd wake up paralyzed, but my back feels great. Have I discovered something?"

"You're exercising the muscles, and a lot of people now think exercise is the way to go," she says. "Also, pushing is better than pulling, and it sounds like you were pushing those trunk sections—we have a study right now to decide which exercises are right for various body types, like if you're strong but stiff, or flexible but weak."

She adds: "I hope your back keeps feeling good."

Me, too. Knock wood.

Since Richard Wolkomir wrote this article, his back has felt much better; he has no idea why. Photographer Richard Schultz is a freelancer based in Cambridge, Massachusetts.

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Clockwise from left: This azure sponge is common in the Caribbean; a yellow sponge grows out from the underside of a coral; the thin arms of a brittle star protrude from a red vase sponge near Belize; a fish peeks out from a rope sponge.

IT MAY SEEM **PRIMITIVE** BUT IT CAN DO SOME THINGS YOU WOULDN'T WANT TO TRY AT HOME

the incredible sponge

BY HENRY GENTHE

AT MIDNIGHT OFF THE COAST OF GEORGIA, WE HOVE TO in the research schooner *Westward*. Under the orange glow of a sodium-vapor spotlight, we watched as the net broke the surface. We heaved at it, slowly pulling it aboard. A few small fish and a couple of shrimp dropped through the netting, but the bag end of the net was clogged and bulging. I undid the knot. We shook the net, and a dark brown, amorphous mass spilled out onto the deck. As we poked through the stuff, we began to feel excruciating needles of pain in our bare feet. Our hands soon followed, along with all exposed skin that had come in contact with the net or its contents. We ended up sitting on deck with hands and feet in the air. Walking or touching anything was unbearable. For the rest of the night, we agonized over our unscheduled laboratory session in marine toxicology presented by the sea creature on deck, a sponge.

Like sponges sometimes do when dragged from the sea, this one had broken apart into taxonomic oblivion. Later, we described our specimen and experience to a sponge biologist, who examined a slurry of sponge cells on a microscope slide and identified our tormentor as *Neofibularia nolitangere* (*noli tangere* is Latin for "Do not touch"). Sharp, microscopic spikes, or spicules, embedded in sponges help identify each species. Toxins produced by these sponges had caused our painful reaction.

Sponges have adopted toxins as a main line of defense against grazing fish and mobile invertebrates. There's nothing quite like an invisible shield of toxic chemicals to keep predators (or marine biology students) at bay. A haze of toxic chemicals surrounding a sponge, like our nemesis *N. nolitangere*, not only deters predators but gives the sponge a competitive edge against more insidious encrusting animals. In the crowded underwater world where solid space is at a premium and planktonic larvae of sedentary invertebrates settle on every available uninhabited surface niche, sponges, corals, colonies of bryozoans, tube worms and algae continuously engage in battles to the death, crowding each other out as they colonize reefs. Many of these battles are chemical warfare (SMITHSONIAN, September 1981).

Biologically active marine compounds, such as these sponge toxins, are much more than a curiosity. They affect different systems in the human body in different ways, and at the right dosages can be lifesaving pharmaceuticals rather than poisons. The race is on to find chemical compounds that offer such promise. In a biological metropolis like a coral reef, where does one start?

John Faulkner, a professor of marine chemistry at Scripps Institution of Oceanography, in La Jolla, California, explains what it was that first alerted him to sponges as a possible rich source of new toxic chemical compounds. "If we go out onto a reef and see something that looks like a large chunk of food—poorly protected, soft-bodied and easy to grab—and nothing is eating it, we assume it has chemical protection," he says. "Organisms that appear to defend themselves chemically rather than by shells and spines, or the mobility to run away and hide, are of great interest to us."

In the continuing assay of chemical compounds for possible therapeutic use in humans, sponges are running neck and neck with sea squirts and gorgonian sea fans, two other chemically rich groups of marine animals. And at least one graduate student has become a millionaire because of a compound found in sponges.

A good example of the possibilities is a molecule we'll call by its abbreviated name, AS-2. It's found in a purple Pacific rope sponge and inhibits the movement of molecular "motors" inside cells, which are necessary for cell division. In theory, it could stop or at least slow the rampant cell division that is called cancer.

Along with researchers at Scripps, Larry Goldstein and colleagues at the University of California, San Diego, and the Howard Hughes Medical Institute set out specifically to find a molecule that would block molecular motors and, potentially, cell division. They enlisted Faulkner, who is an expert on drugs from the sea, and went to work. During the second summer of screening sponge extracts, undergraduate Michael Berdelis and a postdoctoral student, Roman Sakowicz, found the molecule.

PHIL A. HARRINGTON/PETER ARNOLD; P. 50 BRIAN PARKER/TOM STACK & ASSOCIATES; P. 51 HENRY GENTHE; CLAY WISEMAN/ANIMALS ANIMALS; P. SUTHERLAND/OTHER WORLD IMAGES

Opposite: Sharp spicules (shown 1,000 times life size) aid scientists in identifying species.
Above: A sponge releases unfertilized eggs, just one of the many ways sponges reproduce.

Other studies have also been productive. Scientists at Scripps and the Harbor Branch Oceanographic Institution in Fort Pierce, Florida, have isolated dozens of chemical products with potential merit from Pacific and Atlantic coast sponges. More recently elsewhere, a compound with anti-inflammatory qualities has been isolated from a Pacific sponge, *Dysidea frondosa*. A different sponge, *Plakortis simplex*, produces chemicals that could temper the rejection response to organ transplantation.

About 10,000 species of sponges inhabit fresh and salt water. They wait for food to drift by and filter it from the water with a unique system of hydraulics. Sponge food includes any microscopic bits of organic material, living or dead; diatoms and other single-celled microscopic plants and plankton are prime fare. But recently, an unusually aggressive new species of sponge has been discovered, one that eats tiny crustaceans in an undersea cave in the Mediterranean.

Most sponges are barely recognizable as animals and for years were considered to be plants or, as a British herbalist put it in the 1600s, "a certaine matter wrought togither of the foam or froth of the sea, which we call spunges . . . whereof to write at large woulde greatly increase our volume, and little profite the Reader."

Even today, fathoming their real nature has proved no easy task. Back in the laboratory, colorful sponges fade to gray in alcohol and quickly turn to sludge at the bottom of specimen jars. Sometimes only microscopic analysis of their fine structures will reveal their identity. They're not very dynamic in life or compelling in the lab, and so until recently most of the attention and research money went for more dynamic, dangerous or delicious creatures.

In the sea, sponges sit on rocks, reefs and wharf pilings, showing off bizarre forms and bright colors. Tiny red vases and clusters of brown-gray elephant ears could easily grace the halls of a Beverly Hills art gallery. While they are spectacular visually and chemically, however, sponges are

DOUG PERRINE/INNERSPACE VISIONS

A rush of water sucks you down into a pore, or ostium, glowing red from the light. . . . Inside, the passageway opens into a hydrodynamic maze of branching canals.

the simplest multicellular beasts in the animal kingdom. They have no true organs or tissues; a sponge is a hodgepodge of loosely organized single cells that are each specialized to carry on the sponge's day-to-day activities. Multicellular creatures may have started out as such loose confederations.

To best understand them, come with me on a scuba dive. Let your imagination take over. Shrink to microscopic size and roll off the dive boat's gunwale into the warm waters washing over a coral reef somewhere tropical. Exhale, sink down and swim over to that bright red sponge. You will find yourself peering down onto a surprisingly busy and strange landscape of invertebrate animals. By the time a sponge has grown to the size of a cantaloupe, it is a nearly impregnable and inedible fortress of tough skin, sharp spicules and toxic secretions, and often turns into a crowded condominium of weaker, more vulnerable creatures seeking safe haven from predators. (The sponge's formidable defenses pose no harm to such organisms, as they have adapted to the toxins and are small enough to avoid the spicules.)

Rows of tan polyps from colonial anemones called zoanthids polka-dot the red spongescape, while cryptically colored red and white shrimp, well camouflaged from passing fish, confidently stroll about on its surface. An intrepid biologist once picked no fewer than 16,000 shrimp from the holes, canals and crevices that honeycombed a sponge whose interior space was about the volume of a 55-gallon drum. Worms crawl in and out of every open orifice. The arms of brittle stars snake from openings in neighboring purple candle sponges. Cleaning gobies dart into open water from the barrels of cannon sponges to pick parasites from reef fishes.

One of sponges' most amazing partners is the sponge crab (genus *Dromia*). It dexterously snips off a piece of sponge about the size and shape of its shell, hollows out the sponge and pulls it down over its back like a hat, under which it hides from predators (p. 58). The sponge keeps growing, but the crab abandons its cover when it molts.

Back on the reef, you find yourself drifting dangerously close to the caves that riddle the surface of the red sponge. You're swept along on the same water currents that the sponge depends on for the basics: food, oxygen and sex. You drift a bit too close. A rush of water sucks you down into a pore, or ostium, glowing red from the light filtering through the body of your host. Inside, the passageway opens into a hydrodynamic maze of branching canals. The canals lead into spherical chambers lined with choanocytes, clear collar cells that protrude from the walls like Art Deco light fixtures. The choanocytes extend whip-like flagella into the chamber, beating the water into a stiff current, sucking more water in from the outside. In 24 hours a large sponge might pump as much as several hundred gallons of seawater, laden with plankton and bacteria and saturated in oxygen, through its body. Sponges can be very efficient in filtering this water, feasting on as much as 90 percent of the bacteria that flow through with the current.

Through a delicate chemical balance, an anemone shares space with a sponge in New Zealand; currents generated by the sponge may help bring food to both.

Deep in the sponge, you are joined on this Alice-in-Wonderland voyage by amoeba-like cells called archaeocytes, wandering with you through the mesohyl, a mass of jelly that makes up the bulk of some sponges. The archaeocytes are the sponge's wondrous workhorses. They can, as needed, change into any and all of the other types of sponge cells. They help build the skeleton, produce or nourish developing eggs and, by wandering through the sponge, mediate the chemical and physiological responses

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that enable the sponge to react to environmental stimuli in a very low-level way. Some cells around the ostia, for example, can expand or contract to regulate water flow through the sponge.

Now, the archaeocytes creep past, pausing to engulf bits of plankton that are stuck to the collar cells. They ooze off into the distance, disappearing into the red mass on their way to digest and distribute food and rid the sponge of wastes.

Like an aquatic spelunker swimming in a cave of stalactites, you continue your journey. You find yourself winding your way through a tough framework of spongin fibers, avoiding sharp spicules of silica or crystalline lime that protect the sponge as well as help hold it together.

By now most of the food has been filtered out and the water is loaded with carbon dioxide and excreted chemical wastes. Your scuba tank pressure gauge shows that your air level is getting low. But the foray is not over. Your sponge host, and others of its type, are spawning, and the water around you suddenly fills with wriggling sperm. The sponges turn into smoking cannon, blasting white clouds of sperm, along with yourself, out into the open sea from the large central cavity (a feature common to most sponges). Sperm are swept along in a cloud to neighboring sponges, where they are inhaled again through the ostia.

Inside, the sperm are caught by collar cells and picked off by archaeocytes, which carry them to waiting eggs under the care of specialized nurse cells. Once the eggs are fertilized, they develop into microscopic larvae that then move into open water, where they creep slowly about, searching for a hard substrate in the right spot on which to grow into adults.

Thousands of feet below the sea surface an even more bizarre story unfolds. On the muddy, abyssal plain stands an eight-inch-tall, very delicate glass-like cage. The skeleton of fused silica spicules created by the Venus's-flower-basket sponge is one of the deep sea's most beautiful creations. In an amazing coevolutionary relationship, a pair of young shrimp somehow find and enter the cage. Inside, where they are safe from predators, they catch drifting plankton for food and grow so large that they become trapped in the sponge for life. When flower-baskets with their imprisoned crustaceans are occasionally dredged from the seafloor, they are prized by the Japanese as wedding gifts.

Sponges closer to the surface are hardly less impressive. On a dive off Seven-Mile Beach on Grand Cayman Island in the West Indies, I dropped into the water from a boat. Here, every day, several hundred divers on a dozen dive boats hit the reef like a D-day invasion. On the edge of the vertical wall that has made this one of the world's premier dive locales, my divemaster pointed out a huge sponge. An organism of heroic proportions, the sponge was fully eight feet high. It sat like a castle with crenellated ramparts on the reef overlooking a city of fish, corals and other invertebrates. Inside the sponge I could see several cleaner shrimp,

Sponges provide safe hiding places for many organisms, including the brittle star (left, with yellow colonial anemones) and the arrow crab (right).

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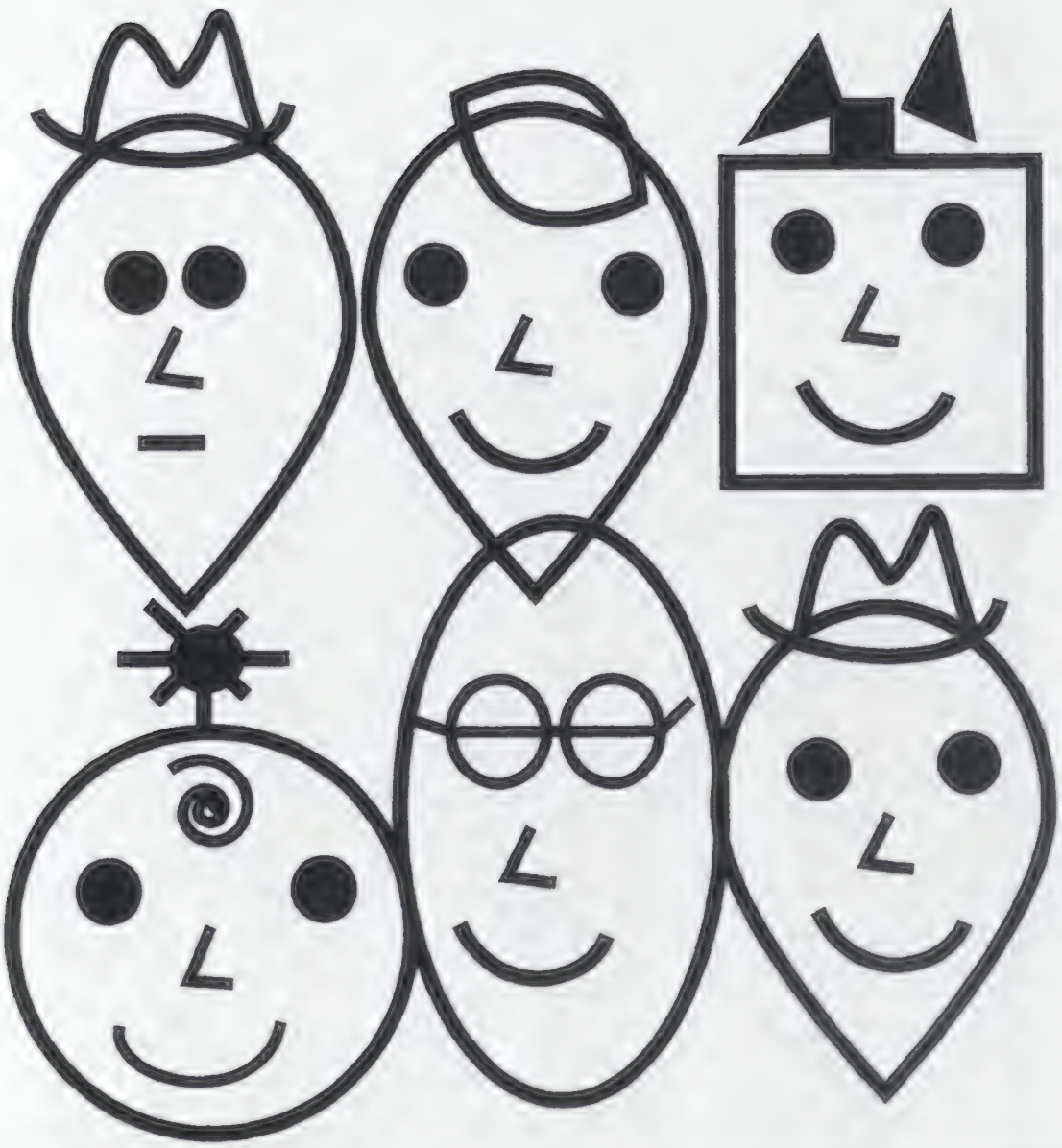

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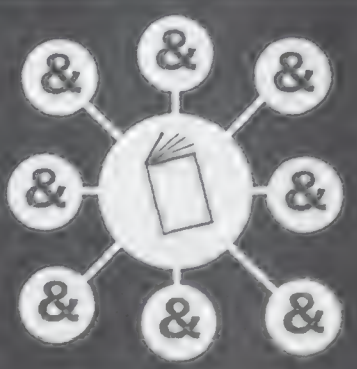

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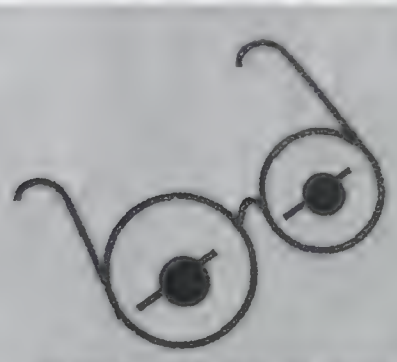

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Top: In Australia, sponges find a secure perch atop some scallops. Above: A crab carries a sponge "hat" for camouflage.

some iridescent striped gobies, and who knows what other creatures lurking beyond the holes that perforated the sponge's surface.

Marine biology classes still repeat simple experiments done early this century to illustrate sponges' extraordinary powers of regeneration. In one, the Atlantic red beard sponge was squeezed through a piece of cheesecloth into a sterile dish of seawater. A couple of days later the dish was found dotted with tiny red beards. Cells from the dissociated sponge had joined forces and fused to create miniature, fully functional replicas of the adult. The experiment was then repeated, but with a mixture of one red and one brownish-purple sponge. Later the petri dish was found speckled with red sponges and brownish-purple sponges, but there were no hybrids. The species specific aggregation reaction continues to have a significant impact on the study of developmental biology and focuses research on the interrelationships of cells in higher organisms.

Contrary to long-held popular and scientific opinion that sponges are sessile (attached to one spot for life), they actually can crawl over the seabed. Calhoun Bond, a biologist at Greensboro College in North Carolina studying ten sponge species, noticed his specimens seemingly getting nearer the top of the aquarium after being kept there for several weeks. Outlining them on the aquarium glass with a felt-tipped pen, he was able to track their progress toward the top. The laboratory speedster was a lavender species called *Haliclona loosanoffi*, which clocked in at more than four millimeters (a millimeter is 1/25 of an inch) a day by extending flat foot-like appendages and dragging the rest of the sponge behind, often discarding bulky pieces of skeleton.

Because of the archaeocytes' amazing capabilities of cellular reorganization and adaptation, sponges can respond to unfavorable environmental changes by simply crawling away, rebuilding their canal systems as they go. If one is damaged by an angelfish (one of the few fishes that eat sponges), instead of building new tissue to repair the damage like a more advanced animal might, a sponge merely mobilizes existing cells to move over and cover the wound, often leaving a scar. Sponges use this flexibility to change shape and spread out, filling irregular open spaces on reefs or rocks, and crowding out more advanced animals. The prize is the rarest commodity on the seafloor: a solid place to settle down and live. Not bad for a "primitive" animal.

Henry Genthe's studies of aquatic life have taken him from the Sargasso Sea in the North Atlantic to the Yangtze River in China.

PHOTOGRAPHS BY ENRICO FERORELLI

The Circus is coming!

IN CITIES ACROSS AMERICA, THE circus parade was once one of the biggest and most anticipated events of the year. The entrance into town of the colorful and noisy procession of performers, brass bands, jugglers and exotic animals, and the bright, shrill notes of the calliope, meant the circus had arrived.

The highlights of the parade were the massive, ornately decorated circus wagons featuring painted "tableaux" or elaborate hand-carved reliefs. Drawn by teams of draft horses festooned with brightly colored plumes, the wagons were designed to dazzle the townsfolk and entice them to the performance at the fairgrounds.

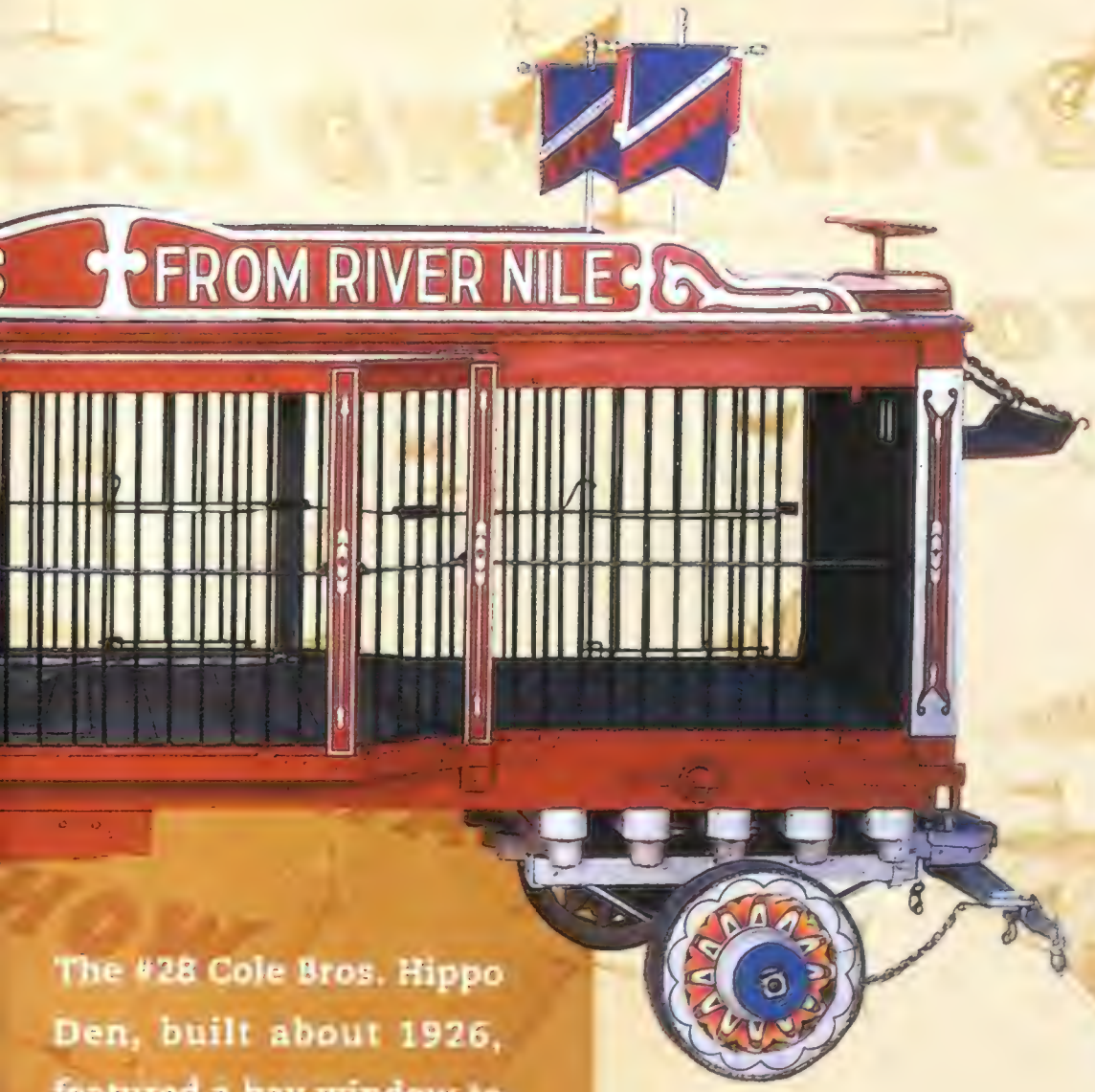
As Fred Dahlinger, Jr., historian at the Circus World Museum, in Baraboo, Wisconsin, explains, "Whether to purchase big top show tickets with their limited disposable income was a decision often made after observing the splendor of the wagons in the show's free street presentation."

Most of the wagons had a functional purpose, too, transporting equipment, costumes, animals and performers. In the early days of circus parades, the horse-drawn wagons themselves traveled overland in a caravan from town to town. Later on, the wagons were carried atop railroad flat cars, unloaded at each circus stop and taken to the showgrounds, where the parade began and ended.

The Miller Bros. 101 Ranch Bandwagon, 1903, features a bas-relief panel of Columbus landing in the New World—a design inspired by a painting in the U.S. Capitol.

The wagons pictured here are on display at the Circus World Museum, which has more than 200 antique circus vehicles in its collection—the largest of its kind in the world. Most may also be seen, along with at least 40 other wagons from the museum, on August 2 in Milwaukee in the annual Great Circus Parade, a reenactment of the magnificent street pageants of yesteryear. —*Karen Larkins*

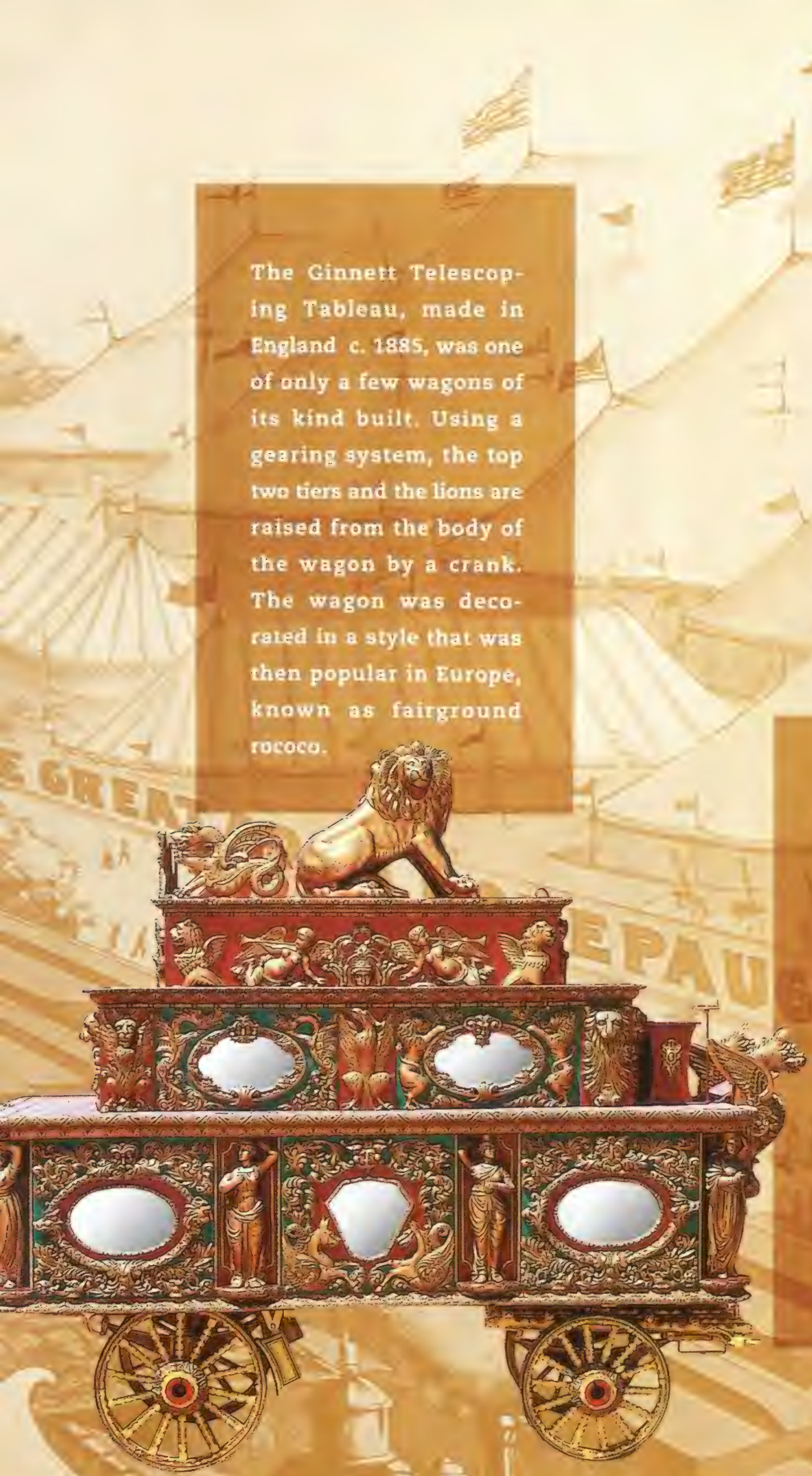
To entertain youngsters along the parade route, Barnum & Great London commissioned a series of seven pony-drawn floats, each representing a different children's verse or fairy tale. This float was built in 1882 and depicted the nursery rhyme "The Old Woman Who Lived in a Shoe."



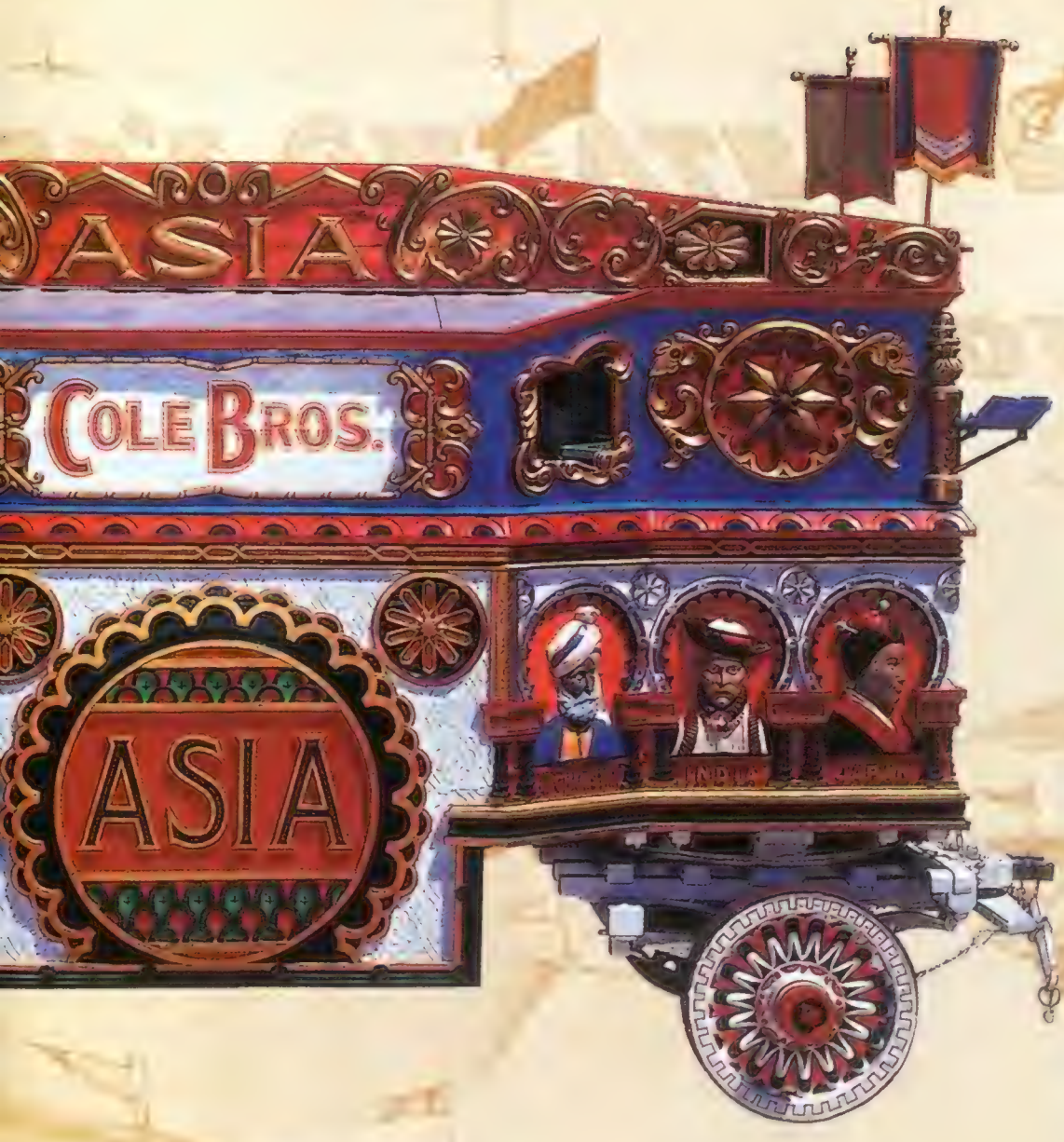
The #28 Cole Bros. Hippo Den, built about 1926, featured a bay window to give the hippopotamus room to turn around and a large water bath for taking dips. Like most cage wagons of the time, this one was painted in a bold color and trimmed with silver to show off the exotic creature inside.

Built in 1903 for the Barnum & Bailey Circus, the Golden Age of Chivalry Tableau, with its flamboyant, three-dimensional dragon on top, was considered in its day to be the most unusual and extravagant parade wagon in existence. The vehicle carried no baggage and was used only for parades.

The Ginnett Telescoping Tableau, made in England c. 1885, was one of only a few wagons of its kind built. Using a gearing system, the top two tiers and the lions are raised from the body of the wagon by a crank. The wagon was decorated in a style that was then popular in Europe, known as fairground rococo.



The Cole Bros. "Asia" Tableau was one of four continent floats built for the 1903 Barnum & Bailey parade. Originally, the wagon had a grouping of allegorical figures on top, representing Asia. Today it is painted in the polychromatic colors popular during the 1920s and '30s and appears much as it did when Cole Bros. owned it in 1935.



The Ringling Bros. Swan Bandwagon, featuring elaborate carvings inspired by the gardens and statuary at Versailles, was built in 1904 by Moeller & Sons of Baraboo, Wisconsin. The wagon served as the number one bandwagon of the circus between 1904 and 1911 and was pulled by a fancy 24-horse hitch.

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Even though they were familiar with Jenn-Air's state-of-the-art induction technology, listening to the agent brag about it was fun nevertheless. Sure, they maintained their composure in the entranceway. But when they saw the kitchen, they just lost it. And, from that moment on, the house was off the market.

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Looking pained, an unknown hobo demonstrates how to ride two of the parallel truss rods underneath a boxcar. It could be made easier, at times, by laying a board across them.

"Hallelujah, I'm a Bum"

BY JAMES R. CHILES

BOB LOGAN'S JOB WAS TO FURROW HIS family's cotton fields. One day Logan, 16 years old and with nothing but cotton and more cotton in sight, obeyed an impulse and jumped into an empty boxcar on a train passing through his Texas town. On the floor of the car, he found a piece of board, and cut this message into it: "Bob Logan Gone West." As the train got under way, he tossed the board out at a road crossing in the hope that someone would see it and tell his mother.

It was fitting: a message in a metaphorical bottle, from a man gone adrift. This was the spring of 1933 and all across the country, desperate young men were reaching for the grab irons of boxcars. For a time during the Great Depression, more than a million men entered the world of the American hobo. There were thousands of boys, and some girls and women, too. They flipped freights, rode the rods, decked rattlers and ditched bulls

Their dusty epic forms the final chapter to the story of that peculiarly American figure, the rail-hopping hobo. He's part documented history, part legend, part clown. Americans prize success, so it might be tempting to write all hoboes off as losers who couldn't find a place in the national dream, simply another addition in the lexicon of America's outcasts, whom we know as bums and drifters, as vagrants and the homeless. Yet the ranks of hoboes and of rail-riding laborers during the lean years included such future notables as novelist Louis L'Amour, TV host Art Linkletter, oil billionaire H. L. Hunt, journalist Eric Sevareid and Supreme Court Justice William O. Douglas, to name a few. Whether celebrities or among the forgotten, old-time hoboes deserve our thanks as the men (and women) who cut the wheat in Nebraska and Kansas, raised railroad beds in Utah, felled timber in Washington, worked as roughnecks in Texas oil fields, picked fruit in California, built the raw towns, and moved on. They did it for very little pay, at great danger to themselves and for virtually no recognition.

They took to the road in jobless thousands to escape failure, seek work — or find a kind of freedom.

Much of the information that comes down to us about hoboes in casual read-

In 1939 Dorothea Lange photographed two hoboes waiting for a ride in California.

ing is a caricature of the good and the bad, like the twin masks of joy and sorrow that symbolize the theater. In Preston Sturges' classic 1941 film *Sullivan's Travels*, a lightweight film director played by Joel McCrea suffers a brief but brutal experience as a hobo. Once again warm, safe and fed, he wistfully tells those gathered around him why laughter is so important: "Did you know that's all some people have?" And in fact it is the shoe-sole-flapping, dog-evading hobo that we laugh at, as portrayed in the old film comedies.

I'll show you the bees in the cigarette trees,
And the soda water fountain
And the lemonade springs where the blue bird sings
In the Big Rock Candy Mountains.

While I don't rank myself as an ex-hobo, I did briefly ride the freights in Montana and western Canada in 1976 to see what it was like, and what I saw persuaded me out of many of these stereotypes. I was a 21-year-old, traveling with my two brothers and three friends. We encountered hoboes along the way who called themselves "fruit bums," after the harvests they worked. We saw the danger of the life; we huddled out of the mountain wind that whipped through the big doors and we gagged in a blue haze of diesel fumes trapped inside long tunnels. We enjoyed the panoramic view. Such travel is grimy; each day on the road left us coated with a fine brown dust from the boxcar floors, as if we had been bronzed en route. Rail riding is not one of my finest achievements—it's against the law and I don't endorse it to my children—but those days made vivid memories.

Even with a little firsthand experience, I still had to jettison plenty of wrong notions during my months of digging into what it was really like to take the hobo road during the darkest years of the 1930s. Depression-era men like Bob Logan spent months and even years on the road, looking not for the Big Rock Candy Mountains but for just a decent job that would get them out of the jungle. Far from dissolute and depraved, these hoboes relied on courage and unimaginable fortitude to face danger, hardship and humiliation. Most were just trying to get along and get by in the grim backdrop of a depressed economy. They used their wits to find work, stay one step ahead of the law and fight off the constant stabs of hunger.

The image of the hobo as a happy-go-lucky, fancy-free bum emerged long after hoboes first hit the rails. Rail-borne transient men first appeared on the American scene in the 1870s (SMITHSONIAN, November 1977). They were footloose veterans of the Civil War, and they scratched a bare existence out of the short-term labor market of the West. They also scared the breath out of many law-abiding citizens. It was all made possible by the growth of the railroads; by 1870, some 53,000 miles of track laced across the nation. This grew to 200,000 miles in 1890, and hit 230,000 miles by 1930. The railroads hauled cattle to Chicago, wheat to Eastern bakers and cereal makers, coal to feed the furnaces of Michigan's mighty River Rouge auto plant, and crude out of the East Texas oil patch.

Hoboes took to the rails the way itinerant raftsmen took to the rivers before the Civil War and hitchhikers would take to the highways after World War II. The origin of the term "hobo" remains obscure and disputed; some say it's a corruption of *homo bonus*, Latin for good man. If so, most Americans had little tolerance of these good men, who looked to be able-bodied beggars living off the fat of the land. As the hobo ranks doubled and doubled again, when the economic panics of 1873 and 1893 threw hundreds of thousands out of regular jobs, the public's fear of these nameless, hollow-eyed men grew in proportion. And rightly so, as many gave up on finding work, becoming instead tramps and bums and yeggs, that is, those who traveled, those who didn't and those who preyed on the honest traveling laborers. A dean of the Yale Law School dismissed them all as "depraved savages"; short stories painted these men as symbols of primitive evil. Popular magazines warned that demented vagrants were derailing trains and commandeering

DOROTHEA LANGE/LIBRARY OF CONGRESS; PP 66,67 BROWN BROTHERS

Falling asleep, even for a moment, could—and often did—mean an instant and gruesome death.

locomotives. Yet many people did help them. The rural communities of America, as elsewhere, had relied on the itinerant for generations to bring much-needed skills, news and gossip, and extra hands during harvest time. A familiar sight was the mushfakir, a hobo who repaired umbrellas. But, instead of a handful of vagrants passing through, their numbers kept growing. Little towns could be overrun when freight trains pulled in.

Public alarm hit a peak about 1914 as Europe descended into world war. Press reports portrayed the Industrial Workers of the World as a rebellion in the making, a subversive tide that threatened cherished American freedoms. IWW members, or Wobblies, often rode the rails in a campaign to organize and recruit hoboes and downtrodden workingmen into their dream of the One Big Union. The *Little Red Song Book*, filled with Wobbly labor songs, included the hobo favorite, "Hallelujah, I'm a Bum," which became something of an IWW anthem. Its decidedly anti-work lyrics did little to help the Wobblies' cause. The IWW faded, a casualty of overpatriotic zeal that came about after the United States got involved in the war.

By the 1920s the scary image was changing. The public had learned that some pretty famous literary folk had ridden the freights—like Jack London and Carl Sandburg, for instance—and they turned out all right. Now the message coming across was that hoboes weren't all that bad; and neither was life on the open road. Maybe they were just grown-up Huck Finns, defiantly independent. The upgraded image got help from Charlie Chaplin as the Little Tramp and from master clown Emmett Kelly. Kelly created Weary Willie, a figure who, with his sad face, ratty clothing and melan-

Though Lange's hoboes were mostly "itinerant single men," she met this family traveling by freight train to find work in Yakima, Washington.

DOROTHEA LANGE/LIBRARY OF CONGRESS

Left: John McCook, who studied the hobo population in the 1890s, set up this idealized portrait of a "feast" in a hobo jungle, with everyone dressed to the nines.

choly worldview, appeared in the Ringling Brothers circus and in cartoons, films, on Broadway and, later, television. Hoboes had newspaper comics, tuneful ballads, vaudeville skits and movie melodramas on their side. The New Hobo was becoming a romantic rogue, unchained and unkempt. "Freedom is the one God I worship," hobo poet Harry Kemp wrote. Brutes no longer, now they were rebelling against fate, if haplessly.

Do you know how a hobo feels?
Life is a series of dirty deals.
This is the song of the wheels.

This freedom came at a cost. Rather than spending their days alternating between filched-pie feeds and harum-scarum misadventures with railroad cops, real hoboes of the Depression spent long days searching and begging for scraps of food and scraps of work made doubly scarce by the fact that many thousands of others were out scouring for the same thing. Hoboes sometimes went days without food. A good job might offer a week of 12-hour days of hard labor, at a wage of one or two dollars a day, or might pay nothing more than a place in a bug-ridden bunkhouse and meals boiled out of spoiled food. Bob Logan of Texas spent his months on the road digging potatoes in Idaho, harvesting Dakota grain and picking fruit in New Mexico. A couple of days' work, then more days looking for the next wage; that was as much as hoboes could expect.

While the drifting and desperate army of Depression-era young men may have looked like so much slag off the melting pot, the appearance was deceptive. Actually, they were more promising than unemployed men of similar age back at home. Gen. Pelham Glassford, chief of police in the District of Columbia in 1932 when the Bonus Marchers arrived to pressure Herbert Hoover for their long-awaited WWI bonuses, reported to Congress the next year that young men who were idling back in their hometowns lacked the "intelligence, resourcefulness, and the spirit of the boys on the road."

Before the Depression, the average hobo was an older man who didn't want permanent employment; but with the upheaval, these old pros were far outnumbered by young men with no prospects, and others who had held good jobs but lost them. The old hoboes adapted by teaching the newcomers about survival on the road. These young men fell into a subculture, fashioned by several generations of rail-hopping hoboes, replete with its own lingo, poetry, code of ethics and honor. The hub of hobo life was the camps, or "jungles," which had much in common wherever they were located. Thomas Minehan, a sociologist at the University of Minnesota who visited many hobo camps while studying juvenile transients of the Depression, said they usually were on the sunny sides of hills, near a source of water, and within walking distance of switch-

BUFFALO MCCOOK ARCHIVES, ANTIQUARIAN AND LANDMARK SOCIETY

yards and coal bunkers. Trees and brush offered shelter from cold winds. A town dump for scavenging made the happy picture complete.

Hoboes living in jungles didn't offer their real names and didn't ask yours; it was enough to travel under monikers such as Toledo Red, Boxcar Bertha or Fry Pan Jack. An unspoken set of rules governed hobo gatherings. The pots were to be left clean; no hobo was to rob a fellow hobo in camp. In the same way that guerrillas must cultivate the generosity of the locals, hoboes lived under a powerful code outside the jungle as well, to avoid angering the townspeople who were the source of odd jobs and handouts. Thievery was to be avoided or at least kept to a minimum: perhaps a pie lifted here and there, some vegetables snitched from a garden, or a clean shirt hurriedly unclipped from a clothesline. But breaking into a house or threatening the local people was an extremely serious offense among the hobo fraternity, and might well bring death.

Walking in on a jungle, a visitor would find fires lapping at old pots or tin cans while hoboes whittled knickknacks and swapped information about good eats and bad railroad police, known as bulls. Everyone was expected to contribute to dinner, most often a Mulligan stew. According to young Graydon Horath, who watched an old hand one day in 1937, preparing such a dinner was as simple as putting water to a boil in a can, dumping in some cornmeal and slices of bologna, salt meat, onions and potatoes, and tending the fire for several hours to keep the food cooking at a low simmer.

From top: Clown Emmett Kelly and comic genius Charlie Chaplin helped make tramps sympathetic. So did Joel McCrea and Veronica Lake in *Sullivan's Travels*, a landmark 1941 film by Preston Sturges.

Mingling in with the hoboes in the jungles were other kinds of wanderers. While the distinctions between them often were blurry to outsiders, the differences were clear enough to jungle residents. "Bums loafs and sits," explained one hobo to hobo chronicler Godfrey Irwin. "Tramps loafs and walks. But a hobo moves and works, and he's clean." William O. Douglas never had any intentions of bumming. "I rode the rails," he said, "not as a sightseer," but to get to places where he hoped to find work. Douglas liked to find a dark corner in a boxcar where he could protect his back. Mixed in with the hardworking stiffs, and indistinguishable at a glance, was a sprinkling of fugitives and hardened criminals ever alert for any whiff of cash. During the boom years of manual labor in grain harvesting, robbers, called yeggs, had formed gangs to reap money from hoboes who were departing jobs in the wheat fields, and they stole thousands of dollars a season. Art Linkletter recalled that two such men held him and a friend up in a boxcar in Washington State, and came within a trigger-pull of killing both of them.

Most important among a hobo's survival skills was learning the finer points of how to "flip" a train—boarding a train, riding it safely, and staying on by avoiding bulls. Hoboes stole rides on both passenger trains and freight trains. And although they would have preferred to board their chosen cars at leisure in the yards, railroad police tried to keep them off any property bounded by the "yard limit" signs. That left hoboes to jog alongside a train as it pulled out, then swing aboard while trying not to slip under the wheels. Of the 216 trespassers who died on the Missouri Pacific's property in 1931-32, most were men who met with accidents getting off and on the trains. Hobo author Tom Kromer describes sprinting along the track to catch a train, reaching for the side of the car, and feeling a step hit his fingers. "I grab it as tight as I can. I think my arms will be jerked out of their sockets. My ribs feel like they are smashed. I hang on. I make it."

Jack London describes a time at the turn of the century when a friend didn't make it. He and a fellow teenager flipped a 10:20 P.M. Southern Pacific going east out of Sacramento. London jumped and pulled himself aboard. His buddy "French Kid" stumbled, and fell under the train, and the wheels took both his legs off. Not aware of his friend's tragic mishap, London decked a "rattler," riding flat and spread-eagled atop one of the cars on an eastbound train.

Boxcars got a 'Bo out of the wind and were hard to beat for all-around comfort, but they held dangers.

"Only a young and vigorous tramp is able to deck a passenger train," he would later write. "The young and vigorous tramp must have his nerve with him as well."

While passenger trains were fast, they offered few perching possibilities. Some daring hoboes scrunched atop part of the brake assembly that was built into the wheel trucks of passenger coaches, ending up with their heads just inches from the spinning steel wheels. In one variation of rod riding, hoboes seized on the iron truss rods used to strengthen wooden railroad cars. The rods hung about two feet apart, 18 inches underneath the car and only about 10 inches from the ground. "The trick," confided William O. Douglas, "was to get a couple of boards and lay them across the rods to form a small platform. We'd lie on the boards, on our stomachs, our heads on our arms and our eyes tightly closed. It was a miserable place to ride because the suction of the train kept dust and cinders constantly swirling." Falling asleep, even for a moment, could—and often did—mean an instant and gruesome death. Carl Sandburg and Art Linkletter both fell asleep while riding on couplings and the tops of cars, and came within a breath of falling beneath the wheels.

Over the years hoboes could be found on or in just about every location aboard a freight train. At various times they were reported riding on the cowcatcher, hiding under coal in the tender, standing on the couplings, hanging on the grab irons that served as ladders, sitting on top of the cars and nestled in gondolas of scrap iron. Boxcars got a 'Bo out of the wind and were hard to beat for all-around comfort, but they held dangers just like anyplace else on a freight train. When my friends and I rode the boxcars, hoboes and rail workers warned us not to sit on the edge of the doorway and dangle our legs out the side; it was bad form not just because it drew the law's attention but because the massive side doors could roll shut in a sudden stop and lop off our legs. Hoboes in boxcars also ran the risk of being crushed under poorly secured cargo, dying in train wrecks or asphyxiating in insulated "reefer" (refrigerator) cars, which were sometimes locked from the outside after an unsuspecting hobo had climbed aboard. At the peak of the Depression, 6,500 illegal railroad riders were killed or injured in a single year.

Accidents might or might not befall, but bad weather was a certainty for hoboes long enough on the road. The triple factors of traveling through the winter, being broke and risking jail are what earn people the right to say they have truly lived the hobo life. Amateurs like me, sometimes called scenery bums, had money to avoid begging, didn't stay

long and got off the road well before frigid weather. "It is a very serious thing for a tender individual not properly clothed, to ride outside in winter weather. I do not see how they can escape pneumonia," R. S. Mitchell, chief special agent for the Missouri Pacific Railroad, told a congressional hearing in 1933. The obvious solution of running south for the winter could be dangerous because Cotton Belt police chiefs and sheriffs were alert against penniless snowbirds looking to roost until the arrival of spring. Beatings, chain gangs and often death awaited the hobo who strayed into the wrong small town.

Of course hoboes' campfire stories cast hoboes as Davids up against so many iron-fisted railroad bulls. Among the Goliaths, a few loomed over the rest. Jeff Carr of Cheyenne, Wyoming, was ranked as one of the roughest, toughest railroad bulls around. By the early 1920s, Carr was a legend from Texas to Maine, writer Glen Mullin reported in his book of hobo travels. A drifter nicknamed Runt described Carr this way: "A big goof he was, wid a slouch-down mustash, cowboy hat, coupla guns strapped on im." He said he had seen Carr gallop alongside a freight, and reach out and grab a hobo off the train and sling him across the horse's neck, like a prize deer. The real T. Jefferson Carr, a Cheyenne lawman and railroad detective, had been rough on hoboes and tramps in the 1890s. According to legend, he was beaten to death by hoboes with a coupling pin, but in fact, he died of a lingering illness in 1916 at age 73.

Railroads often did have legitimate gripes against hoboes. In 1932 railroads were hopping mad about riders who would pick out refrigerator cars full of vegetables and fruit; if the car was too cold they'd open up the ventilator doors wide to warm it up, ruining the food. Hoboes were known to build fires inside boxcars during winter, and occasionally the blazes got loose and burned up the cars. Even so, the accidents caused by the hoboes didn't seem to warrant the violence unleashed upon them by many bulls. One railroad bull explained that some yeggs had once started a gunfight during an arrest and shot his pal. "Since then I club all hoboes on general principles," he reported. Other bulls learned to flush out hoboes riding the rods by lowering a piece of iron tied to a rope from between two cars. The bull would pay out the rope and let the iron whip about underneath the car, killing any hobo unlucky enough to be riding below.

Railroad police, or "bulls," drag a hobo out of a boxcar in the Texas & Pacific yards in the 1920s.

Though some policemen kept up the old brutal ways throughout the Depression, no amount of clubbing and shooting could have kept all the hoboes off the trains. The chief special agent of the Missouri Pacific said that by 1930 most railroads had given up even trying to pinch them, explaining at a hearing why hoboes laughed when threatened with arrest: jail would give them a warm place to rest up

You will eat, bye and bye,
In that glorious land above the sky,
Work and pray, live on hay
You'll get pie in the sky when you die.

By early 1933 the nation was in deep economic trouble, with one out of five able-bodied workers jobless. In the years from 1929 to 1931, the Missouri Pacific's hobo count rose from 13,000 per year to 200,000. As public schools were shuttered for lack of money and banks went bust, even cities with a history of earlier charity to tramps and hoboes before the Crash cut way back on free lodgings and soup lines. Each winter month, the total number of hoboes and highway tramps passing through Deming, New Mexico, equaled the resident population. It would be easy to paint tightfisted cities as just so many Scroogevilles, but officials felt honor-bound to conserve any spare change and available jobs for needy local people rather than a crowd of grimy strangers dumped off by arriving freight trains. Hoboes called such unfriendly towns hostile, which they pronounced "horse-style."

A survey of transients during the Great Depression suggested that perhaps 8,000 women were on the road as hoboes. One woman told a sociologist that the toughest thing was staying clean. Constant hunger she didn't mind so much, she said: "You don't stay hungry after the second day anyhow." Not all women took to the road out of economic desperation. "Boxcar Bertha" Thompson, probably the best-known woman hobo of the era, said it

On a long boxcar ride, hoboes played cards or tried to sleep. Even in open country, and despite great heat, they learned to keep boxcar doors shut for safety.

CULVER PICTURES

A hobo gulps coffee on a back porch as a housewife watches; thousands of men traded work for food.

was restlessness and love of variety that put her on the road at age 15.

Perhaps 200,000 children were loose on American railroads and highways at the peak of the national misery. Sociologist Thomas Minehan lived among them during 1932 and 1933. He found that the boys and girls tended to gather in gangs for safety. Many kept notebooks of their travels. Minehan jotted down this pointed comment from a boy's diary after the writer had visited a mission house: "No use standing up for Jesus. . . . Nothing but beans and misery."

Young people who traveled alone were in real danger from sexual predators. Particularly in the confines of a boxcar cut off from escape or help, hoboes and other transients lived in a strip of land as lawless as the wild frontier. Assaults had always been a problem in the woman-starved hobo life, and well before the turn of the century they had entered the regular hobo lexicon. "Jockers," or male homosexuals, took on boys. Sometimes the relationship required the boys to beg in towns for food or money. Usually it would begin with the older man assisting the boy with advice or food, and then turned into slavery that could last months or years. Some hobo versions of "The Big Rock Candy Mountains" song describe this predator-prey relationship.

And thus another nostalgic image tumbles, that of the noble life of the road. If you spent long enough on the road, you were sure to experience the duality of humankind: some rail workers were brutal, but most were willing to give hoboes a break of some kind. Rail workers' aiding and abetting of hoboes was a quirk of humanity that drove railroad executives wild. Still, it's a pattern that surfaces again and again in hobo accounts and it matches my experience on the road; our group only started riding freights after a railroad employee told us how to manage it.

Take the Santa Fe Railroad's yardmaster at Belen, New Mexico; around 1932 this official ran a water pipe from his house out to the two-acre hobo jungle next door so the dozens of men living there could have clean water to drink and to wash with. Certainly his family was tired of them always knocking on the door, but it was a kinder act than finding enough police to run them out of town.

To see how familiarity bred friendship between some trainmen and hoboes, I visited Portage, Wisconsin, the hometown of Pat K. Windus, a retired locomotive engineer. During the Depression this central Wisconsin city was a terminal of the Milwaukee Road rail line and therefore had hundreds of people on the payroll as icehouse workers, baggage handlers, signalmen, car inspectors, repairmen, brakemen, firemen and engineers.

In 1934, at age 9, Pat Windus lived with his mother and two siblings in a frame house about two blocks from the rail yard. Windus' father had just died, and his mother fed the family by taking in washing, cooking meals for others and baking 35 to 50 pies every night for a local restaurant called the Pig-n-Whistle. All that took a lot of stove wood, Windus said, recalling that they always had four or five long rows of wood stacked up and needing to be split. It was too much for the children; enter the hoboes, who could earn a good meal by stopping by Ma Windus' house to split stove wood for a couple of hours. "They started splitting wood at 5 o'clock most every morning," Windus recalled, pausing like he could hear the "ker-chunk" once more. The transients lived at a jungle a few hundred feet away, on the other side of the rail yard in a grove of trees by Mud Lake. "On our birthdays," Windus said, "they'd bring us some book or toy." Some evenings, the hoboes gathered on the Windueses' porch to listen to the radio.

By the start of World War II, the hobo era was fading fast. While the war's end did turn loose large numbers of veterans, a prosperous economy and the G.I. Bill, which offered them free education, kept most young men from hitting the rails. Nothing like the earlier booms developed. Where once detectives on the Santa Fe might find 500 transients on a freight train, by the early 1950s a thorough search would turn up fewer than 10. All the driving forces had run out of steam. The demand for transient harvest work all across the West dropped off to little more than isolated fruit and vegetable picking, and migrant workers in beat-up automobiles could work that market better. Towns and farms didn't offer the odd jobs and fill-in work so essential to

Mr. Slakey's ninth graders told the town of La Puente where to go.

They meant no disrespect. They were merely presenting their class project: a 20-year general plan outlining where La Puente should be heading in the next century.

During the project Mr. Slakey's geography class walked the square-mile downtown area talking to citizens and photographing forms of land use. They also studied maps and urban-planning documents. Their finished plan was presented before a panel of professional city planners, and then entered in a national contest.

This plan not only gave town leaders practical ideas on land and water use, public housing, and traffic flow, it also taught students the value of critical thinking and teamwork.

For teaching his students that the study of geography goes far beyond the boundaries of charts and maps, State Farm is proud to present Stephen Slakey with our Good Neighbor Award and to donate $5,000 to La Puente High School in California. We're sure his students have great plans for it.

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William O. Douglas rode the rails, he said, "to get to places where he hoped to find work."

the hobo economy. There were jobs for young men now, but employers needed people willing to stay around and learn technical skills, not footloose drifters. And the 1950s saw railroads shift from steam to diesel, which hit hobo lifestyles hard. The simpler operation of diesels cost them the outbuildings they used to shelter in, the friendly railroad families who provided handouts, and lumps of coal that fueled jungle fires. There were fewer trains and they took longer runs, with fewer stops where a hobo could get himself aboard.

In the end, you'll have to reach your own conclusions about the real life of hoboes back when they covered the landscape. Statistics show that for thousands of men it was the way to a dusty death and a nameless grave at trackside. But after his hobo trek, Carl Sandburg noted, "Away deep in my heart now I had hope as never before. Struggles lay ahead, I was sure, but whatever they were I would not be afraid of them." Jack London credited his "realism" and success as a storyteller to his time as a hobo. Perhaps his hobo days colored William O. Douglas' decisions as he sat on the Supreme Court years later and battled for the constitutional rights of all Americans, regardless of their status, wealth or power. Certainly the countless stories from rail-riding hoboes inspired writer Jack Kerouac and the members of the Beat Generation of the 1950s and 1960s.

As for me, I prefer to think of Ma Windus' back porch in Portage, Wisconsin, on a summer evening in 1934. There's a group of men there, weather-beaten but resourceful transients who couldn't fit in, sipping iced tea and listening to the Chicago Cubs on the radio. The whistle of the Milwaukee Road's train No. 263 is sounding in the yards two blocks away. Maybe they'll bid adieu and hop the train for parts unknown; maybe they'll miss the train and catch another one tomorrow. As Pat Windus told me, "It didn't matter. Their ticket was always good."

Frequent contributor James R. Chiles has written about subjects as diverse as radio towers, junkyards and fire fighting.

Hoboes rarely rode atop cars; they were too exposed to weather and detection. But on short stretches before the train picked up speed, it now and then made sense.

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Roman virtues were writ large in David's great Oath of the Horatii, *in which three brothers swear to fight to the death for their homeland.*

JACQUES-LOUIS *David*

STAGE MANAGER OF THE REVOLUTION

EVEN BY THE GORY STANDARDS OF REVOLUTIONARY PARIS, the funeral rites for Jean-Paul Marat were a macabre spectacle. A radical journalist and self-styled "Friend of the People," he had been stabbed to death as he sat working in his bath on the night of July 13, 1793.

It was decided that his lying in state should evoke—with a few theatrical flourishes—the scene of the crime. His body, propped up on a kind of Roman bed, was undraped to expose the gaping knife wound; placed nearby like holy relics were his bloody bathrobe and the crate that served as a tub-side desk. His right arm, hanging over the side of the bier, still held the iron pen he had been using when the fatal blow was struck.

The viewing attracted enormous crowds, and it was hoped that the sight of the slain leader would intensify an outpouring of moral outrage and patriotic fervor the assassination had caused. Marat's unattractive qualities—he was vile tempered, famously ugly and had demanded the execution of countless counterrevolutionaries—were now forgotten. In death he became a saintly martyr to the cause of liberty. Funeral orations compared him to Jesus Christ.

BY ELIZABETH BARKLEY WILSON

The man behind this extraordinary piece of revolutionary theater was Jacques-Louis David. Today David is best known as one of the great masters of French painting—the defining artist of an austere neoclassical style that dominated European art for almost a half-century—and one of the precursors of modern painting. But for a few remarkable years he was also the propaganda minister of the French Revolution—the man who could turn an unruly mob, ready to kill for a loaf of bread, into tearful patriots willing to die for the cause. On demand he produced state funerals and martyr portraits, multimedia pageants for casts of thousands—all designed to keep the revolutionary faith alive, even when the bodies were piling up ten deep beside *la guillotine*.

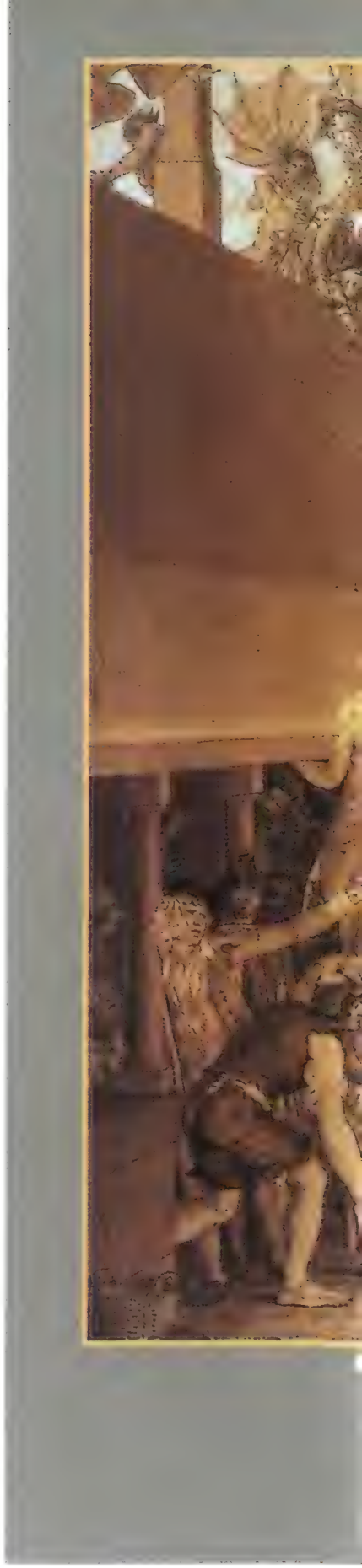
For more than 200 years historians of every stripe have debated how such bloody-minded revolutionary faith was born—in what was supposed to be the most civilized and decorous nation on earth—and how it was kept alive well after any semblance of liberty and the Rights of Man had given way to a tyranny more inhuman than anything Louis XVI could have imagined. The list of probable causes keeps being revised, which is why the Revolution never ceases to fascinate. But one factor—one often passed over—was the very talented and intense Jacques-Louis David.

Born in 1748, the only child of a Parisian iron merchant-turned-bureaucrat, he was a sensitive and high-strung lad, convinced from childhood that he was destined to be a great painter. When his family suggested he take up architecture, David characteristically threw a tantrum. Instead, he entered the Royal Academy of Painting and Sculpture, whose course of training could take 15 years. The Academy, of course, was also the route to fame for any 18th-century French artist.

Time was when pleasing the king and his court meant sending them lighthearted canvases of naked nymphs and boudoir romps in the style of Boucher and Fragonard. But by the 1760s the reforming spirit of the Enlightenment (SMITHSONIAN, May 1997) had been at work. Parisians, long the scandal (and envy) of Europe for their pleasure-loving and frivolous ways, were now intent on appearing to be models of virtue. Moral self-improvement was the rage; the new job of artists, as *philosophe* Denis Diderot put it, was to "make us love virtue and hate vice."

Different styles of virtue were available. Some followed the writings of Jean-Jacques Rousseau who, among other things, not so nice, celebrated nature, simplicity and the purifying effects of a really good cry. A whole crop of Rousseauist artists emerged, chief among them Jean-Baptiste Greuze, creator of the then much-acclaimed painting *Girl Weeping Over Her Dead Canary*. For others, republican Rome seemed to offer the most inspirational model—an ideal society (created, it should be noted, by overthrowing a hated ruler) and one that cherished civic virtue, physical courage, frugality and hard work.

The Royal Academy tended to favor this manlier brand of classical virtue, and painters eager for state commissions were encouraged to cull their Livy and Plutarch for likely subjects. The day came, of course, when idealistic Frenchmen would decide to transform their admiration for republican Rome into harsh reality. But at first, this neoclassicism was merely a fashion. No one saw the convulsion coming, least of all the king, whose art collection became a virtual gallery of antique wisdom and austere, patriotic virtues. Eager to be in step with his times, young David buried himself in the classical past. After completing studies at the Academy, he spent nearly five years in Rome filling 12 fat volumes with his drawings.



Ironically, the man destined to become the great painter of stoic resolve was sometimes given to histrionics and hysterical behavior. There was a halfhearted suicide attempt when the Academy did not award a prize to one of his student works, and he had a nervous breakdown in Italy. But in 1782 he had the worldly sense to marry the rich but rather plain daughter of the contractor of the king's buildings. Financial security was soon followed by fame. At the Academy's exhibitions, held in the Louvre, David's paintings caused the biggest commotion. (On one occasion he was carried around the gallery like a football star.)

When the American Revolution broke out, to many French people it seemed as if the era of republican Rome had come to life across the Atlantic. France (to the king's later and bitter regret) supported England's rebellious colonies with men and a great deal of money. Stories about these brave citizen-soldiers, rising up against a half-mad despot, read like a page from Plutarch. And, although the French had trouble with his name (sometimes it came out "Waginston"), George Washington was idolized as a

In the end The Tennis Court Oath *was never completed, partly because it was so big, partly because so many of the principal characters kept being guillotined as traitors.*

paragon of fancied Roman virtues—brave, self-sacrificing, devoted to his comrades-in-arms and very tall.

Roman virtues were writ large in David's great *Oath of the Horatii*, in which three brothers, lined up toe to toe, embrace as they swear an oath to fight to the death for their homeland. The painting caused a sensation when it appeared at the Salon in 1785 (the American minister to France, Thomas Jefferson, was particularly enthusiastic). It is easy to see why, four years later, the painting was adopted as the perfect emblem of the French Revolution. At the time, however, the end of the monarchy was the furthest thing from David's mind. In fact, the *Horatii* was commissioned for the king himself.

Alas, Louis XVI did not quite live up to the image of fortitude and decisive action celebrated in David's canvas. Overweight and indecisive, he was incapable of dealing with the nation's monstrous financial crisis—brought on in part by the cost of the American Revolution.

By the summer of 1788 the French government was bankrupt. The centuries-old system of privilege put the burden of financing the government on those who could be taxed—the middle class and the peasants, collectively known as the Third Estate. Beyond them a whole system of aristocratic privilege for church and nobles stretched like a huge glass ceiling, preventing even gifted members, among them David, from reaching the highest positions.

Meanwhile, despite the huge public acclaim David enjoyed, the Royal Academy refused to make him a full officer. And in 1787—to his fury—David was passed over for the directorship of the Academy's school in Rome. At

PP 82-83 GRAUDONART REQUIRED

the time, he was at work on his next painting for the king, and its dark and baleful mood matched his own. The subject was Lucius Brutus, the almost inhumanly patriotic Roman consul who had his own sons executed for plotting to restore the emperor. In David's picture the lictors bearing the bodies arrive at Brutus' door. Women collapse in grief, but Brutus, seated alone in the shadows, crumples in his fist the note revealing their treachery.

The picture was still unfinished in June 1789 when members of the Third Estate, summoned to Versailles to help solve the government's financial woes, commandeered an indoor tennis court and declared themselves a "National Assembly." In a scene strangely reminiscent of David's *Horatii*, they swore to create a new constitution for France based—like America's—on liberty and equality. On July 14, a mob stormed the Bastille. In September, Paris was still bristling with alleged royal plots against the Revolution when David's *Brutus* finally—and fatefully—appeared at the Salon. The painting soon came to be taken as a daring commentary on the current political scene—a strident call for vigilance and revenge against all traitors to liberty. This surely came as news to David, who had struggled with the picture for more than two years. Nevertheless, revolutionary Paris was swept up in a wave of Brutus mania.

Speeches and pamphlets invoked his name—"The people of France demands its Brutus!" A revival of Voltaire's play *Brutus* became regular fare around the country, with costumes, settings and stage direction based on David's painting. Performances were accompanied by cheers of "*Vive la Liberté!*" The Jacobins, destined soon to become the most radical and merciless of the revolutionary political clubs, adopted Brutus as a kind of patron saint.

Before the fall of the Bastille, David was a political innocent. Even in the provinces the painter was lionized as "the author of *The Horatii* and *Brutus* . . . whose genius prophesied the Revolution." How much David sincerely believed in the Revolution is still debated. No one was more susceptible to the spirit of the moment or more eager to be a part of the great events of history—and here, assuredly, was history in the making.

In any case, he now declared it his sacred duty to promote the Revolution. By late 1790 he was at work on sketches for a huge painting of the Tennis Court Oath, the moment, by common consent, when French liberty was born. Determined that his painting would be worthy of the grandeur of the event itself, he selected a canvas measuring 22 by 32 feet—roughly the size of a motion-picture screen. (In the end, the painting was never completed, partly because it was so big, partly because so many of its principal characters kept being guillotined as traitors.)

The staggeringly expensive project was to be funded by public subscription, so it was important to stir up interest. To great fanfare, David exhibited a detailed drawing of the work. Even on this reduced scale, it conveys the impression that an event of truly cataclysmal importance is taking place. What appear to be thousands of heads and hands (in fact, 629 took the oath that day) surge together in a cresting wave of patriotic solidarity. As they do, a violent thunderstorm erupts, sending the curtains of the hall's high windows unfurling out over the crowd.

The picture was hung beside David's *Brutus* and *Horatii*. The effect was galvanic. "Frenchmen, run, fly, leave everything," one critic wrote, "hurry to be a witness to the oath of the Tennis Court, and if you are not set on fire and consumed by patriotic flames . . . you are not worthy of

The subject was Lucius Brutus, the almost inhumanly patriotic Roman consul who had his own sons executed for

plotting to restore the emperor. David's Brutus, seated in the shadows, crumples the note revealing their treachery.

liberty." On September 14, 1791, just as David's drawing went on view, the king was summoned to the National Assembly to formally accept the new constitution.

The Revolution, David said, not only provided new subjects "to inspire my genius," it was a chance to be revenged on the Academy. Appealing to the National Convention, which succeeded the National Assembly, he denounced "that Academic Bastille," as he called it, as "aristocratic" and "despotic." Eventually he managed to have the Academy shut down and replaced by an array of new revolutionary art organizations—most of which he dominated, earning him the epithet "dictator of the arts."

It was David's search for support in his battle with the Academy that brought him into the Jacobin Club, and the chance to rub elbows with political heavyweights like Robespierre, the Comte de Mirabeau and the doctor turned-journalist Marat. Most men recoiled from Marat's disfiguring skin condition, which produced running sores on his body, as well as from the ferocity of his revolutionary invective. But he and David became allies, possibly because both saw themselves as victims of persecution at the hands of despotic academicians. In Marat's case, a thriving practice as the purveyor of electrotherapy, using what he called "igneous fluids," had been ruined when the Royal Academy of Science rejected him as a member.

Marat helped launch David into the world of revolutionary power politics. In 1792, he helped get David elected as deputy to the National Convention, thus beginning the painter's fairly impressive record of political office holding, including terms as secretary and president of the Convention. In a political arena where inflammatory oratory was all, David's speech was impaired by a large tumor that had begun to form on the inside of his cheek (probably the result of an old fencing wound). However, the increasingly extremist Jacobins found David useful, indeed invaluable, in other ways. They were eager to be seen as the party of the people—the voice and protector of the humblest citizen. Since the working classes and peasantry accounted for about 90 percent of the population, this was a good move. The problem was, how to control this unruly segment of the population, largely uneducated, illiterate, hungry most of the time and always volatile. Mirabeau, astute and pragmatic, knew: the best "way of acting powerfully on men in the mass," he had explained, "is by means of public festivals.... Among the ancient peoples they worked wonders." David, with his genius for physical drama, was the logical man to take charge.

One of his first pageants was the Festival of Liberty, in April 1792. Ethically, it was a somewhat dubious occasion; the honorees were soldiers who had mutinied and been sold as galley slaves for their sins. Declaring they were not criminals at all but victims of oppression, the Jacobins bought their freedom and arranged a kind of homecoming celebration. The centerpiece of the procession was a giant Liberty chariot with the freed soldiers marching alongside, accompanied by young girls holding their chains. Progress was slowed by stops for dancing, fraternal toasts and patriotic songs. Some estimates put the crowd at 400,000. "You cannot imagine," a student wrote his parents, "how much this *fête* has raised the thermometer of the public temper."

Not long afterward a mob stormed the Tuileries, killing several hundred palace guards and sending the royal family fleeing to the Assembly for protection. Far from being a spontaneous uprising, the whole thing was designed by

He portrays Napoleon as a hero crossing the Saint-Bernard Pass on a fiery white stallion.

the Jacobins and other republicans to force the end of the monarchy—and it worked. By January 1793 France had declared itself a republic; the king had been brought to trial and found guilty of treason.

The matter of Louis XVI's punishment caused shouting matches in the Convention, mostly between the Jacobins, who called for immediate death, and the more moderate Girondists, who urged some less permanent solution. (Tom Paine suggested sending Louis to America for rehabilitation as a good republican.) The vote to execute passed—with David's "*Oui*" dutifully following the Jacobin lead—but not by much. There were last-ditch attempts to have the sentence reconsidered. The Jacobins found themselves under attack as dangerous extremists. Then a prominent Jacobin named Lepelletier de Saint-Fargeau, who had voted for the king's execution, was stabbed to death in a café by a former member of the royal guard. As an opportunity to divert sympathy to the regicide cause, the murder was heaven-sent. David quickly organized a state funeral.

As the headless body of Louis XVI was being quietly reduced to nothing in a lime pit, Lepelletier was given death rites rivaling those held by Achilles for Patroclus in the *Iliad*. (David had painted this very subject as a student in Rome.) The draped corpse was displayed in the Place Vendôme on a high catafalque. Antique candelabras and tripods with smoking incense flanked the pedestal. The lying in state lasted four days; it was said that even those who never knew Lepelletier publicly wept for him.

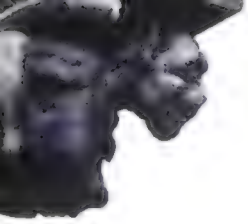
David also produced a painting of Lepelletier on his bier, which was hung behind the speaker's chair at the Convention. Lest anyone forget why he was being so honored, David painted in Lepelletier's ballot paper, on which could be read "I vote the death of the tyrant."

The memorial arrangements for Lepelletier were so successful that they helped create a kind of competitive martyr mania among the Convention's members. Rare was the speaker who did not underline his remarks by indicating his willingness to die on the spot. On one memorable occasion, Marat, responding to the latest attacks on his character by the Girondists, pressed a gun to his temple and offered to blow his brains out in front of everybody. Overcome with the spirit of the moment, David jumped to his feet and demanded to be assassinated, too.

In the end, Marat's martyrdom came, quite famously, in his bathtub, but not by his own hand. His skin affliction required frequent soakings in a medicinal bath of kaolin, and so it was that a young woman from Caen named Charlotte Corday found him on the evening of July 13, 1793. Corday's decision to kill Marat was prompted by Jacobin outrages. Tiring of their tedious war of words with the Girondists, the Jacobins began forcibly ousting them from the Convention and arresting them as traitors. Given Marat's fondness for saying things like "In order to ensure public tranquillity, 200,000 heads must be cut off," it promised to be a national bloodbath.

Pretending to have names of such traitors and concealing a large kitchen knife, Corday gained entry to Marat's rooms. With one stroke she managed to sever his carotid artery. The next morning at the Convention, a representative rose and solemnly asked, "Where are you, David?" Naturally, he was right there, ready to make of Marat the Revolution's most famous martyr. Dispensing with the classical trappings he had provided for Lepelletier, David struck a more realistic note for his painting of Marat. The martyr would be presented at the moment of his death, lying in his bath, scrawling for the "good of the people." The result is one of the most unforgettable images in the history of art. The recumbent pose obviously imitates the familiar image of the dead Christ. The painting was carried in a solemn procession through the streets.

France was now swept by Marat mania. Prints of the dead Marat were distributed by the thousands; a play and songs told his story; more than 30 towns were renamed in his honor. One patriotic parent even christened his son Brutus-Lepelletier-Marat. It was in the name of these martyrs to liberty that the concept of a holy purge—the Terror—took monstrous shape; its chief instrument a bookish and ascetic lawyer from Arras named Maximilien Robespierre. In the terrible months from the summer of 1793 to the summer of 1794 there were at least 16,000 Frenchmen



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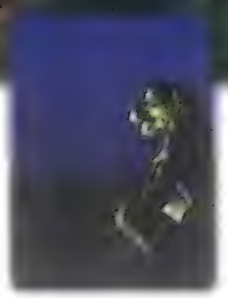

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Marat.
À MARAT.
DAVID.

It was hoped that the sight of the body would intensify an outpouring of moral outrage.

put to death across the country.

During the Terror, the Committee of Public Instruction—David served on it with particular distinction—had the task of inculcating patriotic (Jacobin) ideals on a mass scale. Exhibitions, concerts, theatrical performances and a whole range of public "entertainments" were systematically transformed into organs of republican edification. None were more effective than festivals, of which David was the unrivaled impresario.

His Festival of Unity and Indivisibility, held on August 10, 1793, served as a kind of inspirational kickoff for the Terror. Festivities began at dawn with fraternal libations at the Fountain of Regeneration, a giant female figure with water spewing from her breasts, and ended 16 hours later outside the Convention. Perhaps the most spectacular moment took place on the Place de la Révolution, where a statue of Liberty was surrounded by an enormous mound of crowns and other royalist paraphernalia (most of it theater props). At a signal, the pile was lit and 3,000 white doves were released into the air—each reportedly wearing a little tag that read: "We are free, imitate us."

David was also an active member of the Committee of General Security, one of the policing agencies of the Terror; his signature is on nearly 300 arrest orders. However, unlike Robespierre, who witnessed none of his victims' deaths (public executions, he said, brutalized the character), David was known to sit in the Café Regence sketching the tumbrel's occupants as they went to the guillotine. His most famous subject was the "Widow Capet," Marie Antoinette, sketched on her way to her beheading.

The excesses of the Terror do, in fact, seem to have taken a toll on David's mental state. His speeches became even more rambling, incoherent and, at times, downright delusional. Addressing the Convention in July 1794, when the guillotine was thumping off heads at an average of about 25 victims a day, he invited his colleagues to consider the utopia that France had become—a place of fraternal love, fair weather and painless childbirth.

Unbalanced or not, on June 8, 1794, David produced his most elaborate spectacle yet, the famous Festival of the Supreme Being. It was intended as a kind of mass indoctrination for Robespierre's new state religion—a fairly imprecise form of worship ("its temple is the universe . . . its religion virtue") based on the philosophies of Rousseau, whose works Robespierre is said to have kept by his bedside.

On the morning of the great day, the Place de la Révolution, normally heavy with the stench of blood from the guillotine's work, was redolent with massed roses. "There were girls strewing flowers everywhere," a young girl wrote to her father. "My hair was simply full of them." A chorus of 2,400 parents and children chanted the new "Hymn of the Supreme Being." A cart full of blind children sang a "Hymn to Divinity." Presiding over it all was Robespierre. After a long speech about liberty and virtue springing from the breast of the divinity, he took a flaming torch—David had the honor of handing it to him—and set fire to a giant effigy representing Atheism, Egoism, Ambition and False Simplicity.

During the afternoon session, crowds assembled on the Champ de Mars to find David's pièce de résistance—an 80-foot-high plaster-and-cardboard mountain topped by a statue of Hercules and a very large liberty tree. The final tableau had Robespierre standing on its summit, with the enormous choral group distributed around its slopes and crags.

If the Festival of Unity had heralded the beginning of the Terror, the day of the Supreme Being marked the beginning of its end. Robespierre's decision to cast himself in the role of high priest of a new religion was a fatal mistake for a man already suspected of planning to set himself up as the supreme dictator of the republic. His speech at the Convention the next month, in which he spoke darkly of the need for more "purges," this time within the Convention itself, made even close colleagues fear for their heads. Typically, however, at the end he retreated into the guise of persecuted virtue. Invoking the image of Socrates' suicide, he declared, "Let them prepare the hemlock for me. I will await it on these sacred seats." When Robespierre gave the same speech at the Jacobin Club, David, creator of a famous painting on this very subject, jumped up and exclaimed, to his later and everlasting regret, "My friend, if you drink the hemlock, so will I."

On the following day, July 27, 1794, when Robespierre was denounced by the Convention as a tyrant and calls were made for his arrest, David was nowhere to be seen. "I was ill," he later explained. "I had taken an emetic and could not leave the house for several days." On July 31, three days after Robespierre and 100 of his friends were guillotined, David finally put in an appearance at the Convention. Pale, stuttering, with waves of sweat pouring off him, he tried to assure the deputies that he was no great ally of Robespierre's. His offer to "drink the hemlock" was held up to him as a most damning piece of evidence to the contrary. This was misheard, taken out of context, he contended.

The Convention arrested him on August 2. He spent several months in prison, his life no longer in any real danger since the worst bloodletting was past. During this time he referred to himself as "*in vinculis*" (in chains), but this is self-dramatics. He was not manacled; at least for

Most famously David immortalized Bonaparte as emperor in the great coronation picture, which now takes up more than 600 square feet of wall space at the Louvre.

a time he was allowed to receive guests, and he had his easel and paints, although he complained about the shortage of models. He did have a mirror, however, and used it to paint a remarkably revealing self-portrait.

Once out of prison he vowed he was through with politics, but for a hopeless hero-worshiper like David, the young Napoleon—dashing, charismatic and rapidly gathering up the reins of power—proved irresistible. After meeting Napoleon at a dinner in 1797, David offered to paint his portrait. In rapturous terms, he described the sitting to his students: "What a fine head he has! It's pure, it's great, it's as beautiful as the Antique! Here is a man to whom altars would have been erected in ancient times: yes, my friends, Bonaparte . . . is my hero!"

And so began a second career as painter-propagandist. Early on he portrays Napoleon as the visionary military hero, crossing the Saint-Bernard Pass on a fiery white stallion (in point of fact, Napoleon had quite sensibly made the crossing on a mule). Later, there is Napoleon as the tireless statesman, posed in front of a desk piled high with papers and a copy of the *code Napoléon*. Most famously, David immortalized Bonaparte as emperor in the great coronation picture, which now takes up more than 600 square feet of wall space at the Louvre. As a display of imperial power and pomp, it has few rivals in the history of art—and it pleased Napoleon immensely. David was made First Painter to the Emperor.

With the fall of Napoleon in 1815 and the restoration of the monarchy, David, now in his 60s, was among those exiled as a regicide. He spent his final years in Brussels, where he died in 1825. For years he was reviled as a turncoat, terrorist and political chameleon. (One of his loyal pupils was obliged to paint over the *Death of Marat* in white lead and keep it hidden to prevent its destruction.) David, however, was also a great—and revolutionary—painter. He was born into a world in which painting was an ornament to society, something for the pleasure of the privileged few; his images such as the *Marat*, the *Horatii* and the *Brutus* showed the power of art to electrify the soul of even the commonest citizen. Neither France nor art has ever been the same.

Elizabeth Wilson is a writer and critic who served for 12 years on the staff of the Morgan Library in New York.

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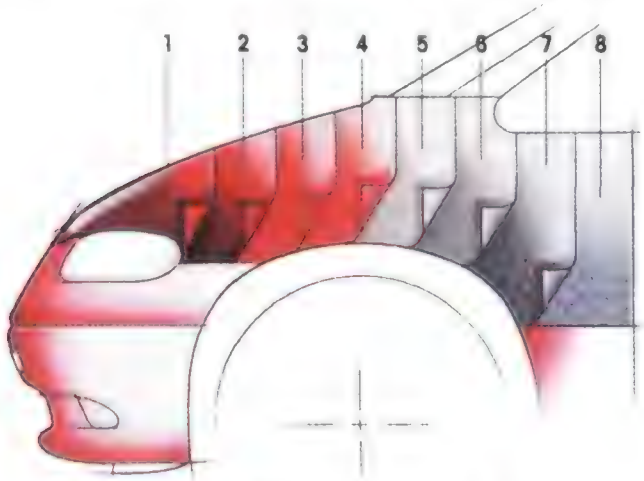

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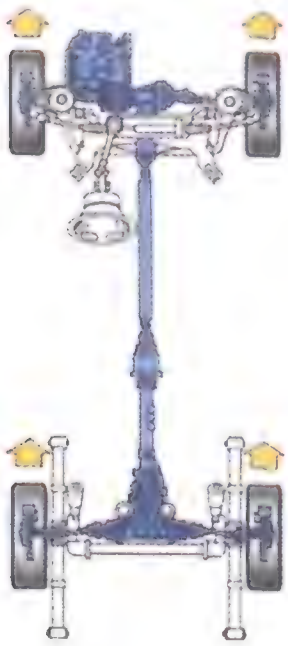

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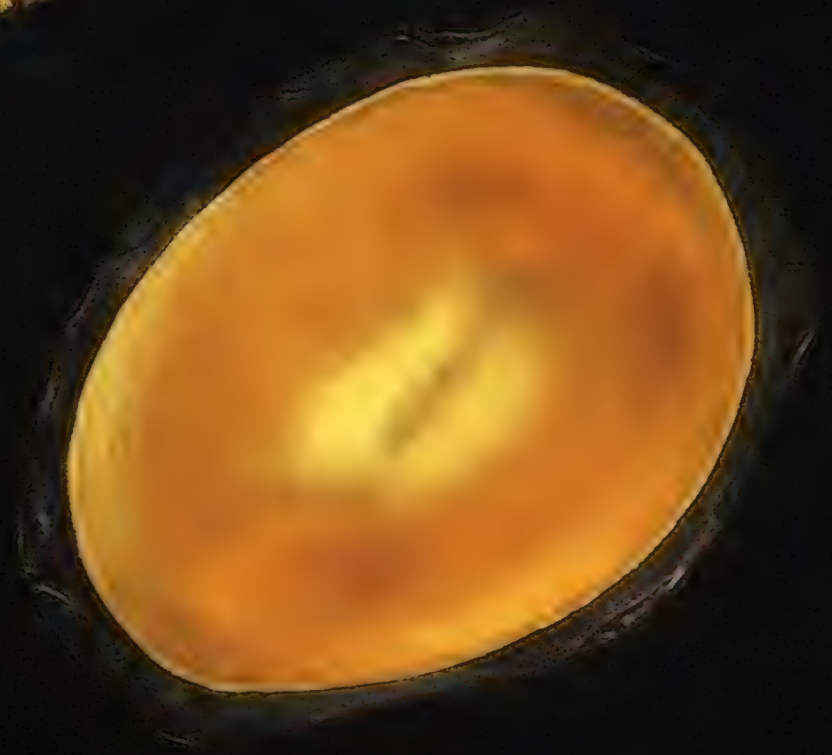
A Brush with Go



Daniel Brush used 22-karat gold, mastodon ivory and Burmese sapphires to create *Silla's Rattle*, 1982 (above, dismantled), for his son. *Black Box VII*, 1991-96 (right, interior view) is made of pure gold and steel. *Justinian*, 1989-93 (far right), is made of pure gold and 22-karat gold.

Id

Sculptures by a modern master using age-old techniques will be on public view for the first time

AT FIRST GLANCE THE OBJECTS APPEAR CRAFTED BY ancient artisans; the detail is exquisite. But these "intimate sculptures" of gold, space-age steel, precious gems and 40-million-year-old mastodon ivory, ranging in size from one to seven inches, are the designs of 51-year-old Daniel Brush. For the past 20 years he has worked in virtual seclusion in a New York City loft-studio he shares with his wife, Olivia, and son, Silla. There he creates miniature masterpieces, each taking up to 1,000 hours to complete.

Before Brush retreated to New York, he was a painter and an art professor at Georgetown University in Washington, D.C. But he had long admired the goldwork of the Etruscans and was fascinated by their techniques. Brush became obsessed with the mysteries of gold and with perfecting his own skills. He revived other techniques—ornamental turnery using 19th-century lathes and steel carving done with chisels. Brush learned about his materials by visiting Pittsburgh steel mills, and about mathematical accuracy by working as a master toolmaker. His sculptures are imbued with his passion for Oriental philosophy, and he attributes his concentration and patience to its discipline.

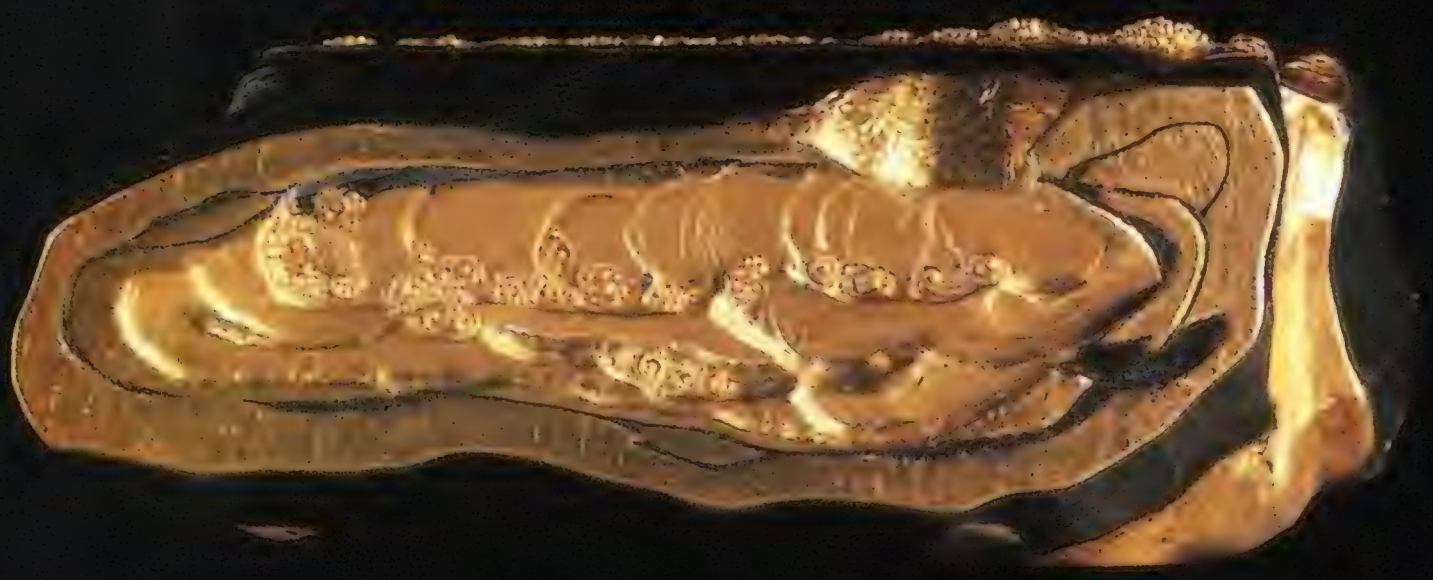
The first exhibition of Brush's sculptures will open September 11 at the Renwick Gallery of the National Museum of American Art. Additional objects will be revealed in *Daniel Brush: Gold Without Boundaries*, a book with photographs by John Bigelow Taylor, to be published by Harry N. Abrams, Inc., next month.

—*Marlane A. Liddell*

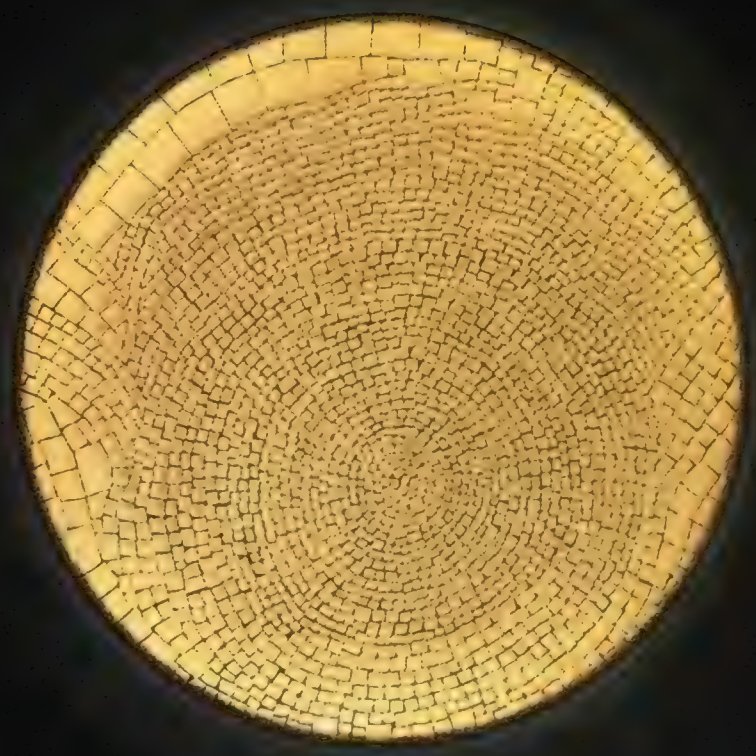
DRAGONFLY BOWL, 1991-93
Pure gold, steel, rare earth magnets

ORB, 1992-95
Pure gold, steel

LEANING BOULDER, 1987-92 (underside)
Pure gold, steel



DANIEL BRUSH IS DRAWN TO THE MIND AND spirit of ancient gold masters. He reworks each object hundreds of times. To fabricate the dome for *Justinian* (page 95), he hammered the gold to a thickness of .002 inch and covered it with handmade gold granules (each .006-.008 inch in diameter). He used a two-haired sable brush to place each of the 50,000 granules to finish the piece. When Brush chisels steel, he wears goggles, welder's boots and leather—chaps, gauntlets, apron—to protect his body.. "Nonetheless, every day that I carve, my hands and chest are covered with steel splinters and blood," says Brush. "The splinters are so fine that they can only be found when the rust appears under the skin."



OLD GROWTH, 1991-93 (top view)
Pure gold, steel

SCHOLAR'S TABLE PIECE, 1994
Pure gold, steel

DOVE FIBULA, 1973 (detail)
22-karat gold

How the Bard Won the West

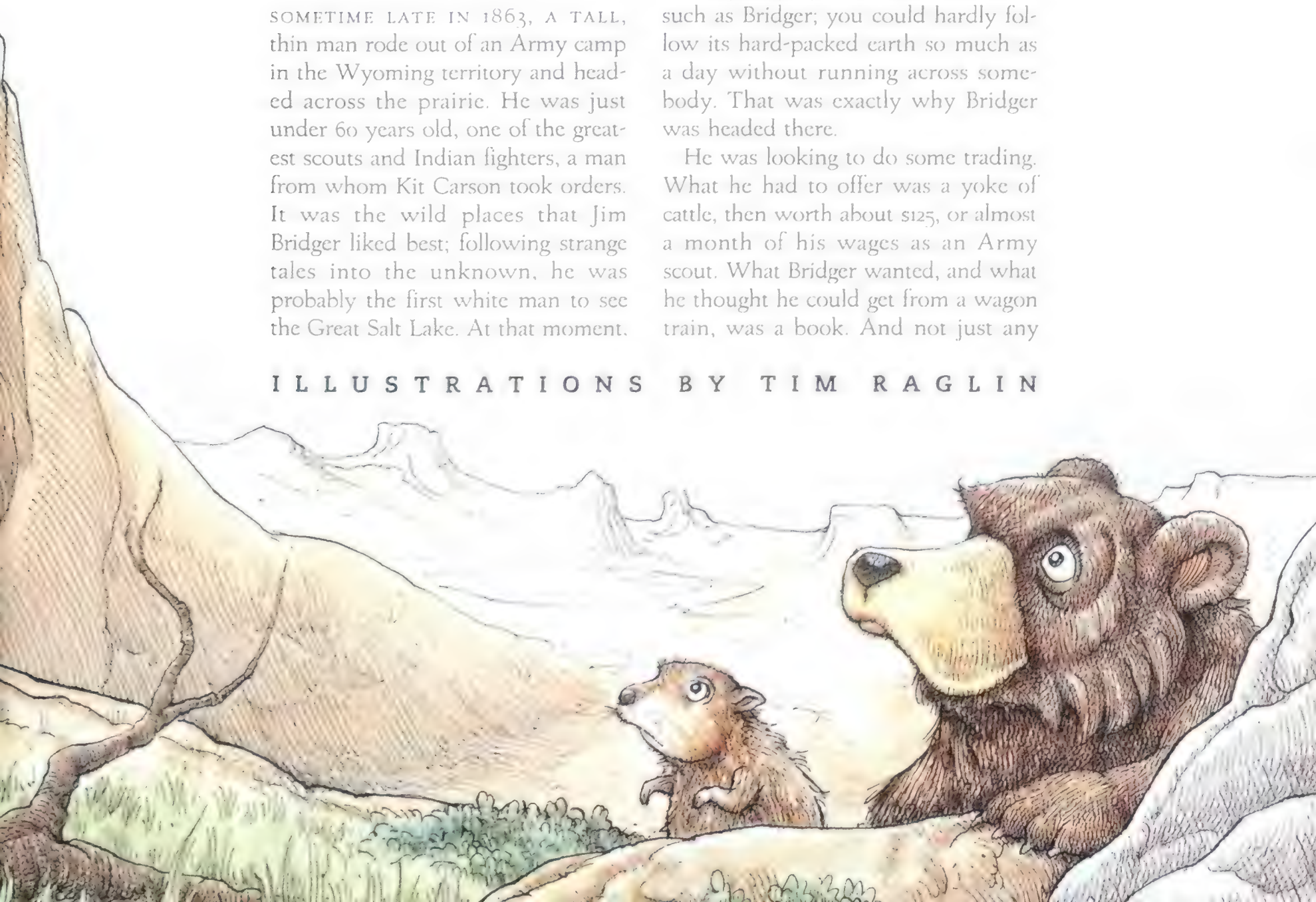
BY JENNIFER LEE CARRELL

MOUNTAIN MAN JIM BRIDGER COULD RECITE SHAKESPEARE WITH THE BEST OF THEM

SOMETIME LATE IN 1863, A TALL, thin man rode out of an Army camp in the Wyoming territory and headed across the prairie. He was just under 60 years old, one of the greatest scouts and Indian fighters, a man from whom Kit Carson took orders. It was the wild places that Jim Bridger liked best; following strange tales into the unknown, he was probably the first white man to see the Great Salt Lake. At that moment, however, he was headed toward people, not away from them. Not too far off, the Oregon Trail snaked westward across the landscape. Traffic had dwindled by 1863, but this "trail" still ranked as a highway by the standards of men such as Bridger; you could hardly follow its hard-packed earth so much as a day without running across somebody. That was exactly why Bridger was headed there.

He was looking to do some trading. What he had to offer was a yoke of cattle, then worth about $125, or almost a month of his wages as an Army scout. What Bridger wanted, and what he thought he could get from a wagon train, was a book. And not just any

ILLUSTRATIONS BY TIM RAGLIN



book, but the book that an Army officer had told him was the best ever written. He wanted Shakespeare.

Bridger's quest might sound unlikely, but all over the American West trappers, cowboys, miners, outlaws, proper ladies, prostitutes and Army officers regarded Shakespeare with a familiar ease and delight that might astonish the average American in the late 20th century. The history of the West, in fact, is a history of playing Shakespeare, of playing *with* Shakespeare, in what now may seem peculiar places and surprising ways.

Bridger, for instance, got what he wanted: someone, going west in wagons that could hold only the most necessary and precious possessions, had brought along a volume of Shakespeare. Out on the prairie, that someone judged the book not quite so precious as a yoke of cattle. For the additional sum of $40 per month, Bridger hired a German boy to read his new book to him. For though he could speak English, French, Spanish and a dozen Indian languages, and though he could draw, freehand, highly accurate maps of the West, Bridger could not read.

He could listen, however, and listen he did. Bridger was already well known as a storyteller. Because he sometimes embellished the already extraordinary natural marvels of the West, and because writers and others made up wild tales and attributed them to him, he also had a growing though undeserved reputation as a liar. That winter, however, he added to his repertoire: from then on he could quote Shakespeare at length. The prospect of an old mountain man spouting Shakespeare now seems more fantastic than the same man spinning tales about salt lakes, glass mountains and hot- and cold-running rivers. Nonetheless, Bridger came to know Shakespeare's cadences of speech so well that his own speech could slide through the poet's rhythms, especially the insults. One of Bridger's tricks was to insert his own oaths into Shakespeare, so that his audience did not know where the playwright stopped and the mountain man began.

Cowboys, miners, proper ladies, prostitutes and Army officers regarded Shakespeare with ease and delight.

In search of the places that Bridger and others once took Shakespeare, I find myself heading off the main roads, and then off-road altogether. Up in Colorado's Gunnison County, I wind north through a wide valley filled with quaking aspen and tall trumpet flowers. Passing beneath the mountain whose sky-hungry spires gave the town of Gothic its name, the road bounces up over a pass and creeps into a darker forest of pine and spruce. This is country that in summer is still best covered on horseback.

But I am horseless, so when I give up on the car, I set off on foot. For somewhere up here, say century-old documents that briefly sound more like *The Hobbit* than legal records, "at the foot of the Treasure Mountain" there lies a mine called Shakespeare.

It was not a spectacularly rich mine, but it was respectable. Two years after it was located in 1879, the last of its original owners, John Blewett, sold out for $30,000. Blewett may have revered the Bard, but he didn't spend all his free time reading. Having sold his rights to the mine, he promptly made his way down to

Gothic and won a shooting contest.

The name is scattered all over the West: "Shakespeare" names a town and a canyon in New Mexico, a mountaintop in Nevada, a reservoir in Texas and a glacier in Alaska. But it was the miners who most often staked Shakespeare to the earth. Nineteenth-century claims called Shakespeare dotted the landscape of Colorado and spilled over into Utah. The mines that still scar Western mountains now seem a curious honorific for a great poet. Yet, Shakespeare takes his place among heroes and sweethearts.

In their quest for distinctive names, the miners delved into the Bard's stories. Colorado sports mines called Ophelia, Cordelia and Desdemona. There is even a "Timon of Athens," revealing that some prospectors dug into remote corners of Shakespeare as well as remote corners of North America, because *Timon* is one of Shakespeare's least-known plays. It is a fitting name for a mine, though, because the play's hero—a mad, bankrupt misanthrope—accidentally discovers "yellow, glittering, precious gold" while digging in the forest for roots

I did not, in the end, find the valley where modern survey maps and ancient mining records suggest the remains of Blewett's mine lie. Far to the south, however, I did find an entire town called Shakespeare. By 1879, Ralston, New Mexico, was short on respectability, having been the site of a diamond-mine hoax that had produced a bank failure, a suicide and substantial losses for investors. In April of that year, therefore, Col. William G. Boyle renamed the town Shakespeare. He already owned the Stratford Hotel, and Main Street was familiarly known as Avon Avenue; soon after, Boyle organized the Shakespeare Gold and Silver Mining and Milling Company. The townsmen joined the trend, organizing the Shakespeare Guards to defend the place against Apache raids.

Shakespeare was more than a name to miners, however. During the gold rush, playgoing had a prominent place among the drinking, gambling and carrying on that was the miners' usual relief from hard and dangerous work. From Colorado to California, theaters that played Shakespeare more than any other playwright perched just across the street, or sometimes right upstairs, from the saloons and gambling halls that were sometimes brothels as well. All over the West, towns built elaborate gilt-and-plush theaters grandiosely called opera houses. A few of these jewel-box theaters still survive in former boomtowns such as Nevada City, California; Tombstone, Arizona; and Aspen, Central City, and Leadville, Colorado. When theaters weren't available people gathered in saloons, hotel hallways or even tents to watch actors play on stages made of packing boxes or boards laid across billiard tables and lit by kerosene lanterns; in Calaveras County, California, actors performed on the stump of a giant redwood.

The greatest actors from the Eastern Seaboard played to packed houses on these stages. Edwin Booth (elder brother of John Wilkes Booth) played his first Shakespearean leads on the magnificent and makeshift stages of California. That this caliber of actor regularly appeared in such venues might have been for adventure's sake, but it was also partly because there was fame and wealth to be found among the miners. In the 1850s, top actors could earn up to

telling and public speaking; if Shakespeare was taught at all, it was taught as oratory and recitation—then parts of the most basic schooling. Since Shakespeare was seen and heard more than read, no one needed much, if any, formal education to have at least a passing acquaintance with the works. Montana rancher Philip Ashton Rollins said that many ranch owners brought Shakespeare west with them. It was not unusual to see "a bunch of cowboys sitting on their spurs listening with absolute silence and concentration while somebody read aloud." Further, Shakespeare was popular because of the poetry, not in spite of it. After listening to the blood and thunder "dogs of war" speech in *Julius Caesar*, one top hand told Rollins, "Gosh! That fellow Shakespeare could sure spill the real stuff. He's the only poet I ever seen what was fed on raw meat."

Among Westerners, the most popular Shakespearean plays were the tragedies and epic histories, with *Richard III*, *Hamlet*, *Othello*, *Macbeth* and *Romeo and Juliet* heading the list. Westerners, however, were not silenced into tongue-tied awe by high tragedy. Like Bridger—who was once heard to say that Falstaff (or "Mr. Full-stuff") liked beer a little too much for his own good and might have been better off with bourbon—cowboys, outlaws, miners and trappers embraced Shakespeare. They brought it to life, retelling it in a mix of remembered poetry and the teller's own salty language.

Along with the enthusiasm came irreverence. It was common in 19th-century American theater to follow the main play, no matter how pro-

$3,000 a week in San Francisco; the best theaters in the East were offering only a tenth as much. But it was up in the boisterous camps that the actors struck gold. In places with names like Rattlesnake, Rough and Ready, Git-up-and-Git and Hangtown, theater tickets were bought with gold dust, and cheering miners tossed nuggets and bags of gold dust onto the stage at curtain call.

The first people to carry Shakespeare into the West were trappers, who threaded their way into the Rockies along the rivers on their quest for beaver. Mountain men were legendary for gathering around campfires to tell bear stories both hair-raising and hilarious. According to the recollections of trappers Joe Meek and Bill Hamilton, however, though they might indeed be swapping bear stories, they might just as well be sharing a little Shakespeare. Or they might even be doing both: after all,

In Calaveras County, actors performed on the stump of a giant redwood.

the Bard's most infamous stage direction, from *The Winter's Tale*, is "Exit pursued by a bear."

On the frontier, Shakespeare was not "Art" to be adored in silent, solitary reading; Shakespeare was a set of stories to be told aloud, language to be tasted, toyed with, tossed about over a campfire. Bridger is a case in point: after he bought his precious book, it never seems to have occurred to him to learn to read. What he wanted from the book was specifically what was in it. Like Bridger, other Westerners might get their Shakespeare out of books, but in books they did not let him stay. The 19th century was an age of oral story-

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found, with a comic song, a dance, and finally a farce in which the principal actors often reappeared. In Denver in 1859, a troupe followed *Richard III* with a polka and a farce called *Luck in a Name;* in San Francisco, *King Lear* was once followed by a dancing horse named Adonis. Sometimes the kind of mischief that led Bridger to alter Shakespeare's oaths took over the stage completely. Audiences loved farces with titles like *Hamlet and Egglet* and *Julius Sneezer*, and burlesque Shakespeare was popular minstrel fare.

Westerners also delighted in creative casting. In Army camps, all-male performances were not uncommon. In Texas on the eve of the Mexican War, Lieut. Ulysses S. Grant was drafted into the role of Desdemona because he supposedly looked the part. Before opening night, however, his superiors had to send off to New Orleans for a real woman, because Grant failed to show "the proper sentiment." Great actresses playing Shakespearean heroes in serious productions were ticket-selling curiosities. The women's success led to the brief vogue of having little girls play the major tragic roles; thus did Anna Maria Quinn, age 6, play Hamlet to a mostly adult male audience at San Francisco's Metropolitan Theatre in 1854. In Deer Lodge, Montana, on the other hand, miners and cowboys were treated to the spectacle of an actress playing Juliet with an imitation Romeo: a "blockhead in every respect" reported one witness delighted by the wooden dummy outfitted with wig and red cambric gown, and even more by the parodic performance that followed.

The actor was driven from the stage by a "well directed pumpkin; a potato relieved him of his cap."

Because Shakespeare—as story or poetry or theater—was shared by so many people, it became a kind of imaginative meeting place. The readings organized by Bridger, for example, brought together an illiterate mountain man, a German boy and the well-educated Army officer who had first recommended the Bard. In the theater, there was no assumption that Shakespeare should be delivered in the plummy tones of the British upper class; audiences flocked to hear their favorite actors play Shakespeare in English heavily laden with German, Polish, French and Italian accents in addition to regional British, American and Australian inflections.

For all the intensity of their love affair with Shakespeare, Westerners had no monopoly on it. In 1849, what is still one of the bloodiest riots in American history broke out in New York City—over styles of acting Shakespeare. A vigorous style was said to be democratic and American, while more cerebral acting was said to be aristocratic and English. Enraged by a supposedly elitist performance of *Macbeth*, a crowd of 10,000 surged outside the Astor Place Opera House (SMITHSONIAN, October 1985). When the mob turned from hurling insults to hurling paving stones, the New York militia opened fire, shooting directly into the crowd; at least 22 people died and 150 others were wounded.

As the frontier straggled westward, the differences that had chafed in crowded New York were stretched out across the continent; Westerners favored flamboyant acting while disdaining polished elegance as snobbish and Eastern. Less than a year after the Astor Place Riot, Shakespeare arrived along with the forty-niners in the California goldfields, and by 1856, the Californians, too, were brawling over Shakespeare. In the West, though, it was not politics but the combination of characters acting badly and actors acting badly that provoked riots.

At a Sacramento performance of *Richard III*, the audience began to get restive in the face of Richard's mounting evil and the actor's obvious incompetence. When at last Richard stabbed one of his victims in the back, the audience began tossing any and all handy garbage onto the stage: bags of flour and soot, old vegetables, a dead goose. At the request of the stage manager, the audience allowed Richard to reappear, but when he placed his sword in the hands of Lady Anne during the wooing scene, "one half the house, at least, asked that [the sword] might be plunged in his body," the Sacramento *Union* reported. The actor was finally driven from the stage by a "well directed pumpkin . . . with still truer aim, a potato relieved him of his cap, which

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Mines that still scar Western mountains now seem a curious honorific for a great poet.

was left upon the field of glory, among the cabbages."

In their noisy displays of pleasure and displeasure, Western audiences preserved and even heightened an exuberant tradition of theatergoing dating back to the Elizabethan audiences that Shakespeare knew. They expected to enter into the spirit of play, and the same enthusiasm that could produce showers of either rotten vegetables or gold dust also provoked, at less frenzied moments, stamping, cheering, whistling and hooting, as well as quips and running commentary on the play, the players and the production.

This freewheeling audience participation had once been common all over America, but in the late 19th century Shakespearean theater was fast becoming an elite and stately affair in the East and in Europe. Western audiences preserved longer their right to play during the play. Appearing as Othello in 1886, Tommaso Salvini was so disturbed by the laughter and popping of champagne corks coming from "Silver King" Horace Tabor's personal box in Denver's Tabor Grand Opera House that he sent a note up during intermission threatening to stop the play if things in Box A did not quiet down. "My theater is a playhouse as much for the audience as for the actors," Tabor reportedly bellowed back. "If that Eyetalian wants to pray," Tabor fumed, "let him go to church."

Nonetheless, changing attitudes eventually traveled westward; Lawrence Levine of George Mason University, in Fairfax, Virginia, has speculated that Shakespeare's fall from popularity in America was caused by large-scale shifts in ideas about what is entertainment and what is art. When Shakespeare stopped being story and began to be art, it began to seem distant; when accuracy became more important than entertainment, it became boring; and when the language of Shakespeare ceased to be commonly heard aloud, it began to seem difficult. Beyond doubt, however, changing attitudes toward Shakespeare have resulted in what now looks like a paradox: Shakespeare's popularity in the American West dwindled as the West was settled and ceased to be wild.

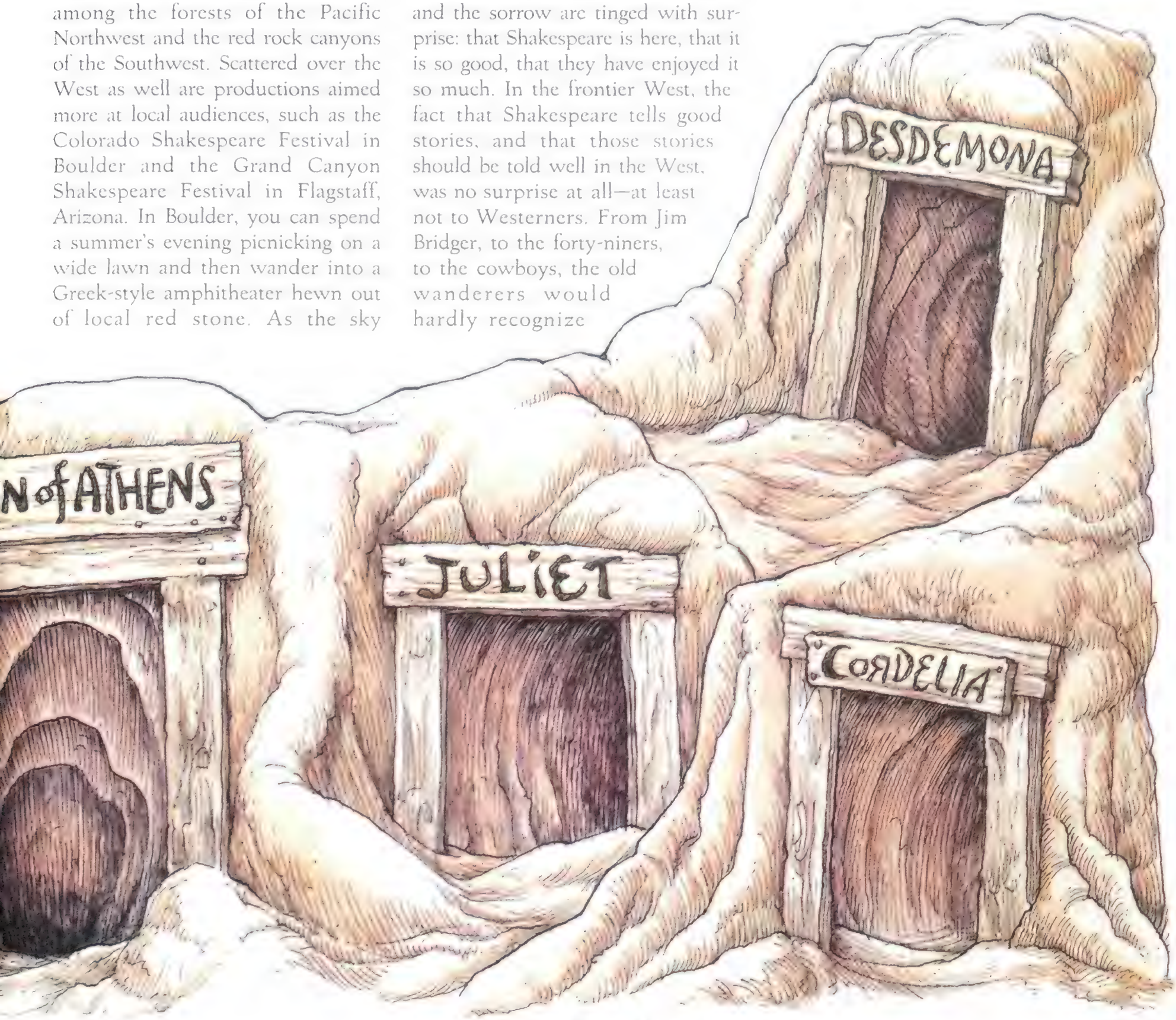
Shakespeare has not, however, disappeared from the West without a trace: it still shapes the myth of what we think the West was, or ought to have been. The novel that established the genre of the western, Owen Wister's *The Virginian* (published in 1902), features an aloof hero who is a dead shot and a deeply honorable man. He is also prone to quoting Shakespeare; the poet's lyricism captivates him. "The singing masons building roofs of gold," he says at one point, quoting from *King Henry V*. "Ain't that a fine description of bees a-workin'?. . . Puts 'em right before yu', and is poetry without bein' foolish." Following the novelists, Hollywood, too, has borrowed from Shakespeare in shaping our idea of the West that was. The film *Broken Lance* (1954), for instance, tells *King Lear* in the guise of a western, while *Jubal* (1956) reshapes *Othello*.

Today up in Leadville, you can, as I did, climb onto the stage of the Tabor Opera House and stand in front of the painted scenery that once backed *Romeo and Juliet*. Facing the plush seats that curve toward you, you can let your voice roll out into the hushed and waiting darkness on the cadences of Shakespeare. In the ghost town of Shakespeare, you can, as I did, duck out of the New Mexico sun into the shade of the Stratford Hotel's long narrow dining room, where the desert wind will send the fine silt of crumbling adobe drifting over your skin and through your hair; there you can listen to the stories that the town's pres-

ent owners, Janaloo Hill and Manny Hough, have spent a lifetime collecting from old-timers.

Yet Shakespeare is more than a ghost in the West. After the Bard ceased to be part of their everyday life, Westerners began to pioneer the Shakespeare festival. Every summer tourists descend upon the towns of Ashland, Oregon, and Cedar City, Utah, to gorge themselves on Shakespeare brilliantly brought to life in faux Elizabethan theaters set down among the forests of the Pacific Northwest and the red rock canyons of the Southwest. Scattered over the West as well are productions aimed more at local audiences, such as the Colorado Shakespeare Festival in Boulder and the Grand Canyon Shakespeare Festival in Flagstaff, Arizona. In Boulder, you can spend a summer's evening picnicking on a wide lawn and then wander into a Greek-style amphitheater hewn out of local red stone. As the sky deepens to sapphire edged by the strange, stark shapes of the Flatiron Mountains that loom behind the set, you can be swept away to some far country on the tide of Shakespeare, sharing the laughter of a thousand Coloradans as Beatrice baits Benedick, or shivering with the hiss of indrawn breath as Romeo forever drinks poison a scant moment too early to see that Juliet still breathes. But here, as I listen to the crowds dispersing downhill through the trees, the laughter and the sorrow are tinged with surprise: that Shakespeare is here, that it is so good, that they have enjoyed it so much. In the frontier West, the fact that Shakespeare tells good stories, and that those stories should be told well in the West, was no surprise at all—at least not to Westerners. From Jim Bridger, to the forty-niners, to the cowboys, the old wanderers would hardly recognize anything in the modern cities that rise on the plains and mountains, strung out like glittering beads along the Interstate freeways. Yet they might recognize and be glad of one thing on such a summer night: Shakespeare still plays well under Western skies.

Jennifer Lee Carrell, a Shakespeare scholar, is on leave from Harvard. Illustrator Tim Raglin recently published a children's book.



Le Corbusier 1887-1965
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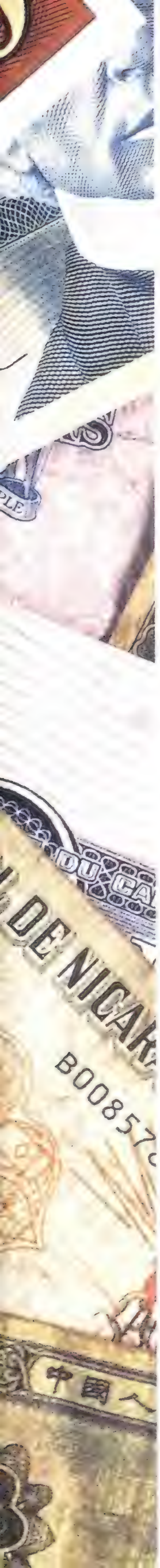

The Art of Money

ACROSS THE GLOBE, THE IMAGES ON A COUNTRY'S CURRENCY OFFER A WINDOW ON ITS CULTURE

WHEN I'M TRAVELING OUTSIDE THE COUNTRY, I generally think about the local currency only in terms of how many—or how few—pounds, francs, kroner, yen or pesos constitute one U.S. dollar. Even with a calculator, I'm usually too confused or flustered to pay much attention to what the money looks like. Compared with our own currency, most foreign notes seem too colorful and too cute, anyway. Haven't we all referred to exotic dough as "Monopoly money" at least once? Since you know you'll be coming back to good old greenbacks, foreign money is hard to take seriously-beyond figuring out the exchange rate, that is.

But the images and designs on paper money say a lot about the country that issues it. Through their money, countries project their self-image—to themselves and to foreigners—and reveal what's important to them, and how they want to be seen by the rest of the world

I first began noticing this on a trip to China some years ago. This wasn't too long after Richard Nixon's Presidential visit, and the Chinese had come up with two separate currencies, one for regular folks and one for the new influx of tourists. The tourist yuan bills were new and crisp and looked like cigarette coupons from the '30s. Engraved on the front were tranquil bucolic scenes, while on the back were instructions in English on the currency's

BY DAVID STANDISH

proper use. The other notes were worn, dingy, somewhat smaller than the tourist yuan, and emblazoned with images not of the Chinese landscape but of socialism and industrialization on the march: happy workers bearing hoes, a mighty freighter steaming along. China was supposed to evoke images of waterfalls for us, but happy, communal socialist work for the Chinese people.

The $100,000 bill with Woodrow Wilson's image was used only in federal transactions.

The dual Chinese currencies reminded me of the vast difference between most Caribbean island currencies and Jamaican money. The face of the Cayman Islands' dollar bill, for instance, bears a portrait of Queen Elizabeth II. To her left, there's an open undersea pirate treasure chest filled with gold coins (which could be taken as a subliminal advertisement for Cayman banking practices, I guess), while the back depicts a coral reef scene of serene tropical fish.

Bermuda's turquoise two-dollar bill bears a familial resemblance, too: Queen Elizabeth on the front, flanked by a sea horse and an anemone. And most of the Netherlands Antilles' bills feature adorable engravings of birds, the only exceptions being the nostalgic port view on the one-gulden note, and an airliner in flight (presumably whisking in tourists) on the 2½-gulden note. But Jamaican money offers nowhere near as much soothing escapism.

One of the appealing things about Jamaica is that it's a country, not just a beach; you can see this on the money. I happen to love the place, and have read Jamaican history, so I know about the guys on the two-dollar bill and the ten—Paul Bogle and George William Gordon, respectively. Both were leaders of the failed Morant Bay Rebellion of 1865—a movement to give greater rights to newly freed slaves—and both were executed for their trouble. True, the two-dollar bill (no longer printed but still legal tender) does have a lovely emerald streamertail hummingbird (also called the "doctor bird") hovering next to Bogle. But on the back is a happy, racially mixed group of kids, a shining sun and the words "Out of Many, One People."

Paper money can also tell you something about what shape a place is in. I remember visiting Haiti a year or so after Baby Doc Duvalier took over, with Tontons Macoutes everywhere, sinister behind their pitch-dark sunglasses, automatic weapons slung over their shoulders. You didn't need to read the United Nations report to feel the heartbreaking poverty of the place, with its open gray-blue sewers and kids with bloated stomachs. And even the money was depressing—tiny bills so worn and dirty they felt greasy, the images on them all but lost beneath years of being passed hand to hand. Sadly, nearly 30 years later, this hasn't changed.

Runaway inflation is something else that's affected money for the worse. This is particularly true in Latin American countries, where it's lowered not only the value but also the aesthetic quality of the money. And many notes of lower denominations have simply disappeared. I still have a red-and-black one-peso bill from my first trip to Mexico in 1964. In the center, shown in meticulous detail, is the wheel of the Aztec calendar. It's printed on excellent rag paper with splendid engraving, and suggests blue-chip stock certificates of a bygone era. Today that's been reduced to a small brass-colored coin reminiscent of a New York subway token.

Countries suffering galloping inflation also have been dropping zeros from their notes—and changing the

During the 1970s, China disbursed concurrent sets of notes: for its citizenry, idealized depictions of a workers' paradise (left) characterized the standard, everyday tender; crisp new bills (right), minted for newly arriving tourists, offered renditions of a timeless landscape.

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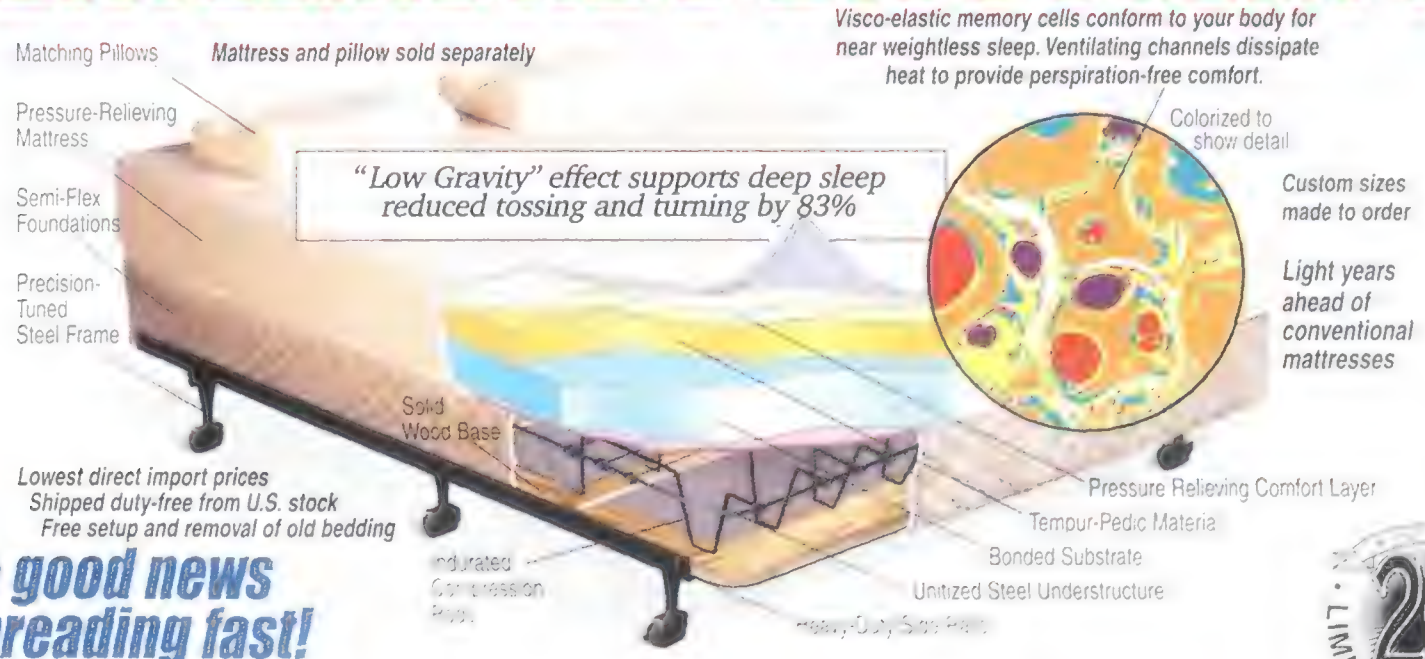
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bills so often that they've sensibly resorted to using cheaper and cheaper paper, since today's big bucks can be tomorrow's candy-bar money. In Peru in 1977, for instance, 80 soles equaled US $1. By 1986, it took 18,000 soles to make a dollar, so the government introduced the inti, equal to 1,000 soles. In 1991, six zeros were lopped off the inti, and the new sol created the equivalent of 1,000,000 intis. This represents a mind-boggling devaluation spiral. No wonder Peruvian bills aren't built to last. Even the just-minted new soles—the ten, for instance, featuring J. Abelardo Quiñones wearing aviator goggles and a picture of him flying upside down (he was a young, heroic pilot who died in the 1941 war with Ecuador)—have the insubstantial feel and slightly blurry look of a photocopy.

Another new wrinkle in money—or maybe the absence thereof—is plastic. Australia no longer prints its notes on paper. They're now made of a polymer that looks and feels fairly paperish, but has a certain slipperiness to it that seems somehow untrustworthy. The notes also have a clever new anticounterfeiting device: little see-through cellophane-like windows with hologram designs embedded in them.

The overall look of the bills is eye-catchingly busy. On the front of the ten, for instance, is emblazoned the central head shot of A. B. "Banjo" Paterson (the poet who wrote the lyrics to "Waltzing Matilda") wearing an understated Western hat. To Paterson's left, a cowboy gallops on horseback, flicking a whip at a group of wild horses that seem to be racing out of Banjo's right neck and shoulder like spooked equine Athenas. These images are superimposed on a profusion of op-art circles and curves, in a smear of colors including blue, yellow, green and violet, plus the see-through window with a windmill in it. Little danger of nodding off while handling Australian money.

The front of Australia's ten-dollar note features a head shot of A. B. "Banjo" Paterson, the poet who wrote the lyrics to "Waltzing Matilda."

Something else that's interesting about various currencies is that the national heroes depicted on the bills generally don't mean squat two doors away. "Banjo" Paterson, for instance, was certainly somebody I'd never heard of before I began looking into this. Also J. Abelardo Quiñones. As someone who takes a certain pride in

The Peruvian ten-sol note pays homage to fearless pilot J. Abelardo Quiñones, killed in the 1941 war against Ecuador.

blabbing out *Jeopardy* answers in front of my kids, to prove I'm not as completely dumb as they think I am, encountering these famous unknowns was a seriously humbling experience.

I figured the people pictured on the most common bills would generally be those best known or most important to a particular country. (I based this assumption on our choice of George Washington for the $1 bill.)

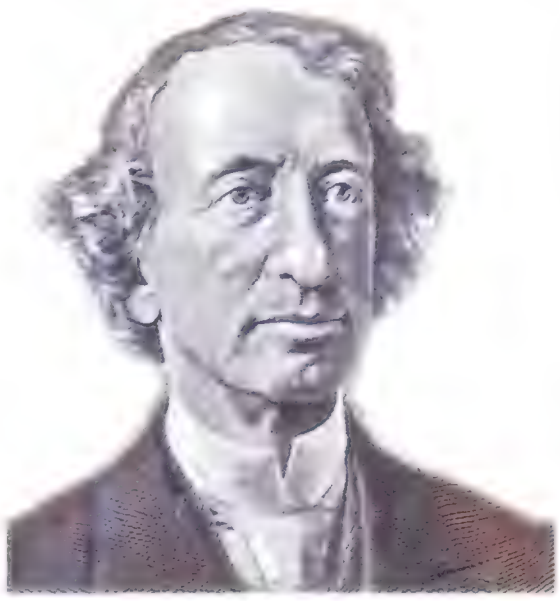
Given the standard cultural bias in what has passed for my education, I didn't feel too bad about not knowing who D. Sukhbaatar was on the Mongolian 50-tugruk note, say, or Alhaji Sir Abubakar Tafawa Balewa (who gets the prize for the longest name I encountered) on Nigeria's five-naira bill. I was relieved to find that my *Encyclopaedia Britannica* knew them both. Sukhbaatar was a revolutionary leader in the Mongolian war of independence from China after World War I, and Balewa was Nigeria's first federal prime minister, killed in an army coup in 1966.

But I felt I ought to know who the distinguished gent in the stiff white collar on Canada's five-dollar bill is. Sir W. Laurier? I didn't have a clue. But then I didn't know who J. A. Macdonald (who looks a bit like Pat Paulsen did on *Laugh-In*) on the ten-dollar bill was either. You probably do. Laurier was prime minister between 1896 and 1911, and Macdonald was Canada's first prime minister, serving two terms between 1867 and 1891. "Though accused of devious and unscrupulous methods," the *Britannica* says, "he is remembered for his achievements." Not by me, until now. I'm proof of why our neighbors to the north think we're arrogant and ignorant when it comes to them.

Hey, I'm sorry, eh?

At least Canada has Queen Elizabeth II on a couple of its bills. And England, of course, is a breeze in that respect. By my count, 16 currencies feature her—although she looks considerably different from one to another. Oddly, the Bank of England notes are the least flattering. She's squinting slightly, her mouth a bit puckered, as if she's just eaten something that didn't quite agree with her; she resembles Prince Charles more than one might want. She's the youngest and most fetching on some of the bills from the Isle of Man and St. Helena. She appears oldest and most grandmotherly on certain currencies from the Bahamas, the Fiji Islands, Gibraltar and Guernsey. In some of these places she's two ages at once, since earlier and current bills are both in circulation.

France is also fairly easy, partly because the names are printed with the portraits: Claude Debussy on the twenty-franc note, Antoine de Saint-Exupéry on the fifty, and Paul Cézanne on the hundred. I'm very fond, as well, of an earlier hundred-franc issue featuring a portrait of the



A portrait of Canada's first prime minister, J. A. Macdonald, initially elected in 1867, graces his country's ten-dollar bill.

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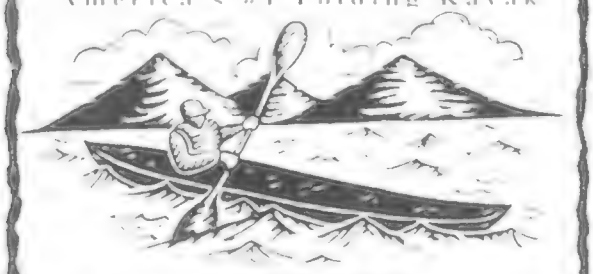

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Jamaican money memorializes the 19th-century freedom fighter Paul Bogle and lauds the island's diverse population.

painter Eugène Delacroix, looking sensitive and a little world-weary, and to the right in the background, a detail of "Liberty," a zaftig and topless revolutionary beauty holding a banner aloft. Fairly daring for money, but at least one version of this bill had featured her far more prominently and colorfully on its back. This change is perhaps an indicator of increased puritanism here in the '90s, with even the French toning things down a bit.

Switzerland, though, right next door, has money peopled with quite an obscure cast of characters. Possibly because lucre is the country's main concern, if not its obsession, the Swiss seem to be slightly fanatic about it. The people on the bills are definite candidates for a round of "Double Jeopardy": Leonhard Euler, Charles-Edouard Le Corbusier, Horace Bénédict de Saussure, Conrad Gesner, Sophie Taeuber-Arp, Francesco Castelli, Charles-Ferdinand Ramuz, Albrecht von Haller, Auguste Forel and Jacob Burckhardt. I was 2-

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French notes lionize heroes such as artist Paul Cézanne (top) and aviator-writer Antoine de Saint-Exupéry.

for-10. Even I know who Le Corbusier is, though I couldn't exactly say what buildings he designed, and I remember reading Burckhardt's gossipy anecdotes about naughty Renaissance popes in an undergraduate history course—but I'd always thought he was German.

And Swiss francs look fairly surreal. The backs especially, with images superimposed on images superimposed on images, create an airy (and slightly bananas) collage effect, made crazier by the daunting array of anti-counterfeiting squiggles and curves that serve as background. It's as if the committee that came up with them couldn't reach a compromise and so decided to put on every idea anyone had. For such a composed country, the money seems a little wild. What's more, the faces on the front of the newer bills are positioned sideways, so that to "read" them, they have to be stood on end, and additionally feature blasts of color in sliding intensities, like sections chopped out of a prism. The overall effect is pretty strange, especially on the new ten-franc note, whose yellows, encompassing and rising from Le Corbusier's head, give the impression of nuclear fusion emanating from his brain. It's so weird that it's actually one of my favorites out of all the currency that I examined.

Another of my favorites is Ecuador's thousand-sucre note. Aesthetically it's hardly among the most remarkable, but the portrait on the front is of Rumiñahui, his strong, determined face scowling up into the sky in defiance. He looks like the Charles Bronson of the Amazon—and gets my vote as the toughest-looking guy on any money in the world. He was truly a heavy-duty dude, a general of the Incan army. After his boss, Atahualpa, capitulated in the Spanish invasions, Rumiñahui rebelled. He took over Quito, killing or sequestering the virgins to prevent the Spanish from violating the Incan maidens. He also hid Quito's treasure from the plunderers and burned down the city. The Spanish eventually did him in, but they never found the missing treasure. Hey, don't mess with Rumiñahui!

But my very favorite bill couldn't be less martial. And I'm not alone in liking it best. Several people I talked to at Thomas Cook International, who spend their working lives shuffling the various currencies, agreed. It's the face of the Netherlands' fifty-gulden note, to me the prettiest of them all. The image is a close-up of a bee on a single sunflower, colored a cheery yellow with some orange and green, and detailed with quintessential Northern Renaissance precision. It's money fit for framing.

Which is something that can't be said for our own money, which gets my vote as the world's most boring. I

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think it's the only national currency that's based on a dreary green color. If that isn't emblematic of our puritan past, in which money was viewed as a necessary evil instead of something that should be colorful and beautiful. I don't know what is.

Our money is also fairly weird.

I mean, what must people of other countries think when they see that enigmatic, glowing eye, balanced on a pyramid on the back of the $1 bill? That the United States traces its origins back to visitors from outer space

Portraits of Queen Elizabeth II, from Canada (top), England (center) and the Bahamas (bottom), bespeak a far-flung empire.

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The back of this Swiss ten-franc note displays a dazzling technical complexity devised to deter would-be counterfeiters.

who purportedly founded Egypt?

And what sort of country would put Salmon P. Chase on what was its largest circulating bill—now outmoded but still legal tender—the $10,000 note? Civil War buffs will recall that Chase was Secretary of the Treasury under Lincoln, but really, wouldn't W. C. Fields or Marilyn Monroe or William Faulkner or Mickey Mouse have been better?

The new fifties and hundreds aren't much of an improvement. They have buildings on the back—the Capitol and Independence Hall, respectively—and the portraits on the front are still U. S. Grant and Ben Franklin, but the heads, well, they're too big. They look like characters from the cable cartoon show *South Park*. And with the new, bigger print to go with them, as a friend of mine noted, they seem to have been designed by aging baby boomers for aging baby boomers—all of us who can no longer read without our glasses. MONEY: THE LARGE-PRINT EDITION.

Actually, the weirdest picture is on the back of the $10 bill. Stare at it for a while sometime. In the first place, it's an etching of the U.S. Treasury Building, which is an institutional narcissism that a number of other currencies also indulge in. (It would be more forgivable if the backs of most of our U.S. bills didn't also feature representations of buildings. More of our uptightness about money, if you ask me.)

The $10 bill is also one of our few notes with ordinary citizens on it. I count seven tiny figures standing in front of the imposing neoclassical Treasury Building, which is the star of the etching. Except for a single 1920s-vintage vehicle, the street in the foreground is empty.

I look at this and wonder: What does this say about America? For one thing, in this driving-besotted land, it's disturbingly appropriate that we felt compelled to depict an automobile. There's an everyday bleakness to the scene, which might have been painted by Edward Hopper or photographed by Walker Evans. There's a lonely, nondemocratic feeling to it that I'm sure no one ever intended—but it's there.

But unlike the Netherlands' lovely fifty-gulden note, at least this bleak scene will pay our bills.

While writing this article, David Standish began wishing he ran a country so he could put Chuck Berry and Pogo on the money.

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Darwin's Dreampond: Drama in Lake Victoria

Tijs Goldschmidt, translated by Sherry Marx-MacDonald

MIT Press, $25; $15 paper

No Mercy: A Journey to the Heart of the Congo

Redmond O'Hanlon

Knopf, $29.95

Vintage, $14 paper

Camping with the Prince and Other Tales of Science in Africa

Thomas A. Bass

Moyer Bell, $13.95

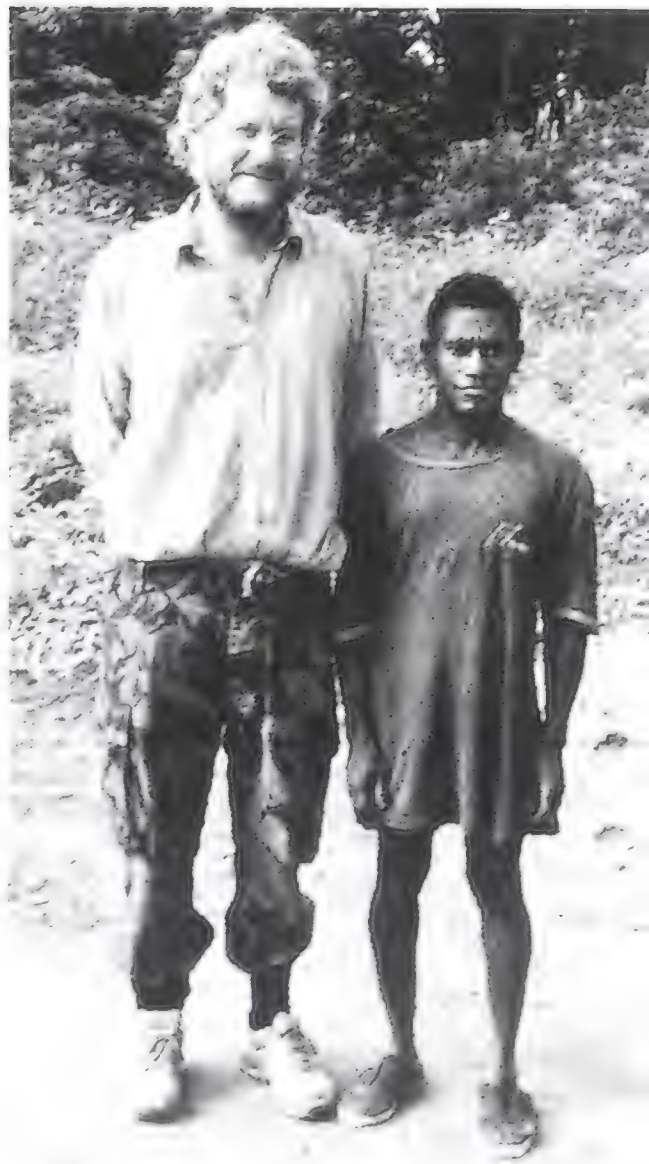
NATURAL HISTORY IS THE FOCUS OI two recent books about Africa, one by a Dutch fish ecologist, the other by a British travel writer. The authors approach Africa with different temperaments, and motives, yet both lead us to lakes where the mysteries of evolution confront the curiosity of the rational Western mind. It is a gift of these books that they do not entirely replace mystery with explanation. A third book, by an American journalist, shows a more practical side of African science, focusing on the search for answers to the continent's problems, from famines and loss of wildlife to new virus outbreaks.

In *Darwin's Dreampond*, Tijs Goldschmidt offers a fresh, almost breezy account of a young scientist's fieldwork and thoughts, as he tries to bring order to the explosive taxonomy of fish in Lake Victoria and to make sense of the order he discerns. Goldschmidt studied cichlids, locally called furu, a group of small perchlike fish, whose radiation into countless species in Lake Victoria is an ecologist's dream come true.

Lake Victoria's cichlids are akin to Darwin's finches in the Galápagos Islands: in both cases, the variations provided an isolated picture of how adaptation to different niches could lead to the rapid evolution of new species from a common ancestor. But as an endless number of different forms were pulled from the lake in Goldschmidt's nets, the ecologist's dream became a taxonomist's nightmare. "How could I ever learn to distinguish these different fish from each other?" he writes. "Were they in fact biological species? . . . I became increasingly uncertain about what a species was. The longer I reflected on the concept, the vaguer it became." In clear and candid prose, Goldschmidt reviews various theories of how species evolve, and shares his meditations on their shortcomings as well as their explanatory successes.

Goldschmidt's accounts of the fish are full of fascinating detail as he introduces us to the fanning out of furu forms: algae scrapers, with file-like jaws to scrape algae from rocks; snail crushers, with an extra set of jaws in their throats powered by strong muscles; scale scrapers, with a long rasp made of 11 rows of teeth that can scrape the protein-rich scales off other fish; two kinds of fish eaters, those that play dead, lying in ambush to attack their approaching prey, and those streamlined for fast attack.

Since furu are "mouth breeders," the females swimming around with their eggs and newly hatched fry in their mouths, some species feed by ramming the mouths of these females



and eating the dislodged offspring. And each predator species has developed its own specific way of ramming, hitting the throat or mouth from below, or crashing down on the snout from above.

But Goldschmidt's mind can be as interesting as what it is studying, and it is refreshing that he doesn't hide this from us. "Anyone who works with fish more intensively than with people over a period of years," he confesses, "starts to see different personalities in the various species. The algae-eating philosopher, the snail-swallowing pimp, the larvae-sifting housewife. . . . I projected human qualities onto the fish—an activity considered anathema by every right-minded scientist—and, in turn saw fish in humans. . . ." While shopping at the open market in nearby Mwanza, Goldschmidt reports wryly, "I continually spotted traces of fish personalities in the faces of Africans.

The Congolese biologist lectures the Westerners on the science of a Pygmy named Muko, their guide.

Indians, and Europeans. In passing, I whispered their Latin names under my breath."

It is ironic that a book that illuminates the evolution of species in so many ways ends up describing a mass extinction of species. While Goldschmidt collected cichlids to understand their evolution, he found that he had become a witness to an ecological disaster. The Nile perch, a large fish introduced into Lake Victoria in order to improve commercial fishing, almost wiped out the cichlids (SMITHSONIAN, December 1988). "Within a single decade," he writes, "the differentiated biotic community that had coevolved over a period of at least fourteen thousand years, and perhaps even hundreds of thousands of years, had changed into an impoverished mess."

Yet there is a further irony at the book's end. Ecologists assumed that once the Nile perch devoured the cichlids, their numbers would also crash from lack of a food supply. But it didn't happen, because a population of prawns, once dined on by cichlids, exploded and fed the Nile perch. And a new cichlid species began to appear, a kind of hybrid that seems to demonstrate a degree of resistance to the perch. Here again, Goldschmidt reminds us of the errant facts of life, concluding, "Every time we predicted something, the ecosystem surprised us by taking an unexpected turn."

REDMOND O'HANLON'S BOOK NO MERCY looks at natural history with less scientific insight, but no less fascinating results. O'Hanlon, once the natural history editor of the *Times Literary Supplement* in London, is joined by an animal behaviorist from America, and the biologist director of the Congo Republic's Ministry for the Conservation of Fauna and Flora, on an expedition through the heart of central Africa's Pygmy country. They are bound for the remote, almost inaccessible Lake Tele, long reported to be the home of a living sauropod dinosaur known as Mokele-mbembe, the Congo's version of the Loch Ness monster. O'Hanlon avidly chronicles many rare jungle species: giant eagles with claws on their elbows, large enough to carry off antelopes; the Congo dwarf crocodile, which growls from its forest burrow; the hammerkop, a bird that is the size of a pied crow and builds a huge nest so strong a man can stand atop it.

O'Hanlon is as interested in culture as science, and can jump from taxonomy and genetics to fetishes and jungle spirits. As his party observes a fly-

ing squirrel, the Congolese biologist lectures the Westerners on the science of a Pygmy named Muko, their guide: "In Muko's world, that squirrel is part-bird, part-mammal. He's a link between the birds and the rat. He connects the air to the ground. And when your wife is pregnant, you can't eat him—not until your child can walk by itself, not until you're certain that [the child] won't die, fly away, join the spirits!"

As he reaches the shores of Lake Tele, O'Hanlon is taken to a sacred spot by a local villager named Doubla, and he records this exchange: "'Look,' I said, feeling like some nineteenth-century ethnographer, 'I'm sure you can tell me the truth in this holy place. There's something I'd really like to know. Have you seen Mokele-mbembe?'

Bass' theme is the need for science to grow African roots rather than transplanting Western assumptions, a process full of new insights.

'What a stupid question,' said Doubla, looking genuinely surprised, stopping with the water-bottle halfway to his lips. 'Mokele-mbembe is not an animal like a gorilla or a python. . . . It doesn't appear to people. It is an animal of mystery. It exists because we imagine it. But to see it—never. You don't see it.'"

IN *CAMPING WITH THE PRINCE*, JOURnalist Thomas A. Bass explores African science in a collection of profiles, describing the heroic work of both Western scientists working in Africa and Africans who are creating their own scientific institutions and traditions. The book was written in the late 1980s and well deserves republication now. Bass' theme is the need for science to grow African roots rather than transplanting Western assumptions, a process that is full of surprises and new insights.

Visiting laboratories and deserts with Bass, we find that the nomads usually blamed for overgrazing and desertification are actually better at preserving arid lands than the gov-

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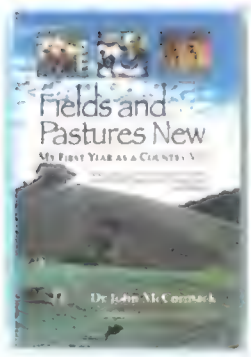
ernments and development agencies who resettle them. We learn that famines are caused not by drought but by breakdowns in economic relations (there's often plenty of food in the markets, but starving herders can't afford it because the price of their cattle has plunged). And we find that some green revolution crops requiring fertilizers and pesticides may end up feeding fewer people than the indigenous varieties they replace.

Bass visits a wide array of successful research projects, from work on pheromones and tsetse flies to studies of termites and viruses. Termites, he tells us, are the oldest type of organized community on earth, and in Africa the termites and ants outweigh all mammals put together. They would seem to be a natural resource, but one research project, designed to harness termite enzymes that extract energy from cellulose, didn't lead to any practical application: "Termites proved too clever for us," the scientists concede.

The scientists are the heroes of Bass' accounts, but too often there are villains in the ranks of government bureaucrats and international development experts who fail to support the findings of African science. As one researcher puts it, "Even if you know what needs to be done, the powers that be won't necessarily allow you to do it." And as a nomad says to a researcher who proposes a new system for surviving droughts, "Your plan sounds very good. But I doubt that anyone would ever do anything so sensible."

Paul Trachtman is a freelancer who is based in rural New Mexico.



Fields and Pastures New: My First Year as a Country Vet
Dr. John McCormack
Fawcett Columbine, $12

NEWLY HATCHED FROM VETERINARY school, John McCormack set up practice in Choctaw County, Alabama. He was the county's first veterinarian. And he had hurdles to leap.

"Is this the venetian?" callers would ask. Some addressed him as the "vegetarian." He was called the veneer, veteran, vetran, vitnery, vanadium, vendetta, even the Vatican. Meanwhile, he vied with homegrown "experts," who dispensed such nostrums as a burlap sack soaked in burnt motor oil, to cure hog lice.

Ten minutes after the McCormacks arrived at their new home, their first customer knocked, a mill worker in overalls. He carried a beagle pup. "I

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reckon he's been poisoned," said the man, giving the favorite local sick-dog diagnosis. A 4-year-old girl stood beside him, pretty and blue-eyed. But McCormack could read the family history in "her sad, dirty face and ragged dress." Diagnosis: hookworm. McCormack's own dog donated blood. A few days later, the restored pup returned home, tail wagging, a good omen for the new practice.

This book is the Southern hospitality version of James Herriot's veterinary tales from rural England. McCormack does not quite have Herriot's gift for splitting sides or inducing throat lumps. But he takes us to a world that can seem more remote than Herriot's British dales, and he makes it seem like home.

It was 1963. All was not, of course, magnolias and manners in Alabama. McCormack notes the plight of black farmers in this relentlessly segregated state. And taking on a federal contract to inspect cattle, he discovers the local hatred for government—the same government that would, by extension, enforce desegregation. But those grave issues are, by and large, not his subject here. When McCormack tested a herd positive for brucellosis, the enraged rancher drew back his fist. But the would-be attacker abruptly keeled over. "For the first time in my life," says McCormack, "I had witnessed, firsthand, an acute attack of snuff overload!"

One farmer explained how he treated his sick cow: first, he split open the tail and sprinkled the wound with salt and pepper to cure an imaginary ailment, "hollertail"; next, he bored into the horns to relieve the equally imaginary "hollerhorn"; and then, said the farmer, "I treated her for the tightback with a turpentine-soaked corncob." Meanwhile, the farmer said, his wife had "heated some lard and I poured that down 'er just in case she'd been snake bit, and then I been givin' 'er some high-priced sick cow powders that I got from down at the co-op." From the veterinarian, the farmer sought advice. "Reckon there's anything else I could do fer 'er?" he asked. "I haven't missed anything, have I?"

McCormack learned to be politic. "Your cow," he would tell a farmer, is suffering from "chronic energy deficiency." He might add the technical term—"Meager Manger Syndrome." It meant "Your cow is starving." Helping an interestingly named farmer, Stink Clark, the vet tactfully suggested that his cow was suffering from "hardware disease"—swallowing nails and wire strands that had been left lying in the paddock.

It was an uphill trudge, introducing scientific animal care. McCormack, meanwhile, learned a few things himself. For instance, cows actually do throw up, sometimes on the young vet who has just proclaimed they do not. He learned not to drive his prized truck into sodden spring pastures. And he learned about decency from a poor farmer, after saving the family's sole cow with a calcium injection. He left with $10, a big bunch of collard greens, two pounds of homemade butter and a hamper of sweet potatoes.

During a year of plying the back roads, McCormack had amputated a dog's leg on a porch and had seen huge "bubbas" faint at the first spurt of blood.

During a year of plying the back roads, country music on his radio, McCormack had amputated a dog's leg on a porch and had seen huge "bubbas" faint at the first spurt of surgical blood. He cured Sir Alfred, a rich woman's beloved ram, but then presided at the pampered sheep's funeral after it discovered and ingested a 50-pound sack of dog food. He tried to catch a pet monkey in a tree, but McCormack's acrophobia froze him on a high branch and he required help from volunteer firefighters. He later received in the mail six packages of peanuts and a note: "For your monkey. You can have some too while you are resting in the tree. THE MONKEY PHANTOM."

There was Tiger, the spoiled Chihuahua, who learned to be a real dog. And there was Wild Eddy, the drunken client who chased McCormack on a golf course in his jeep. Moonshine was offered. One veterinary incident left McCormack driving through town wearing pink Jockey shorts. Walter, the local policeman, stopped him, stared, then asked about a dog with worms.

Early on McCormack told himself, "I think I'm gonna love these people!" By the end of that first year, he did.

Writers Richard and Joyce Wolkomir review books from their home in Vermont.

The Beach: The History of Paradise on Earth

Lena Lencek and Gideon Bosker

Viking, $25.95

Sea Shells

Paul Valéry

Beacon Press, $18

EVERY SUMMER, EVERY WINTER, AND often enough during the seasons in between, millions of humans around the globe make their way to the beach. It is, says Lena Lencek, "nature's most potent antidepressant," a place to wallow in "sybaritic impulses" or to be narcotized by the natural rhythms of wind, water, sand and sun. Public or private, hidden corner for solitary musing or crowd-

ed place to see and be seen, this intersection of land and water has something for everyone. "It is to the beach," say the authors of this delightful dip into social history, "that we go to reinvent ourselves."

Social history is a little bit like an Impressionist painting. Rather than being a quest for some indisputable, photographic truth, both offer a personalized view of some facet of human life. Facts are the social historian's colors, and the picture that each author produces depends not only on which details he or she selects but on how those details are then put in place.

Is it winter or summer? Bright or gray? Do we see a couple strolling on a sunlit shore? Or a weather-beaten boat bobbing beneath a lowering sky? Lencek and Bosker write in cerulean blue and cadmium orange, splashing their pages with a dramatic vocabulary of crimson and viridian green. There are no swathes of umber or sepia, no cautious qualification or stuffy passive constructions. This is a bouncy, hyperbolic book, sensual and fun, and absolutely stuffed with an enormous collection of esoteric and entertaining detail.

The sand at Florida's southwestern tip has "the color and feel of uncooked semolina," and a sunburn is "a flaming carapace of pain." Miami, during the early decades of this century, drew speculators "the way saltwater taffy draws flies." In 1878, Coney Island's Hotel Brighton Beach offered "champagne on draft at ten cents a glass," while in turn-of-the-century Europe, the Riviera served as a veritable Babylon where the "monied widows and neglected wives whiled away the night waltzing and tangoing with danseurs mondains hired by the hour."

Lencek and Bosker deploy their colorful phrases and scores of illustrations to explore three general themes. The authors are interested in how beach behavior reflects prevailing views of health, how beaches offer a refuge from the strictures of respectable society, and how attitudes about sex and the human body translate into standards of dress and undress at the beach.

When Shelley was away from water he "languished so acutely that only by plunging his head into a washbasin could he revive his spirits."

Two centuries ago, the English treated sea bathing as a mix of therapy and penance. They paid professional "dippers" to forcibly dunk their naked bodies into the frigid water of the North Sea and gulped down glasses of seawater for its putatively curative powers.

To the Romantics, sea bathing—particularly in the warmer waters of the Mediterranean—was a transforming experience. It released them from gravity and offered a sexually charged immersion into another world. Byron swam the Hellespont, and when Shelley was away from water he "languished so acutely that only by plunging his head into a washbasin could he revive his spirits." Their

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example added spiritual health to the catalogue of restorative and curative powers attributed to the beach.

The beach had its share of dangers, too. Drownings were common, as many beachgoers had only the most rudimentary experience with the water and were at best just marginally capable swimmers. And young women who came to the seaside to be cured of their melancholy or tuberculosis were—at least in the urban legends of the 19th century—tempting prey for "some handsome scoundrel, who all too often seduced and abandoned them."

During the first half of the 20th century very little of the human torso was actually visible on the beach. The length and cut of women's suits were regulated, and in some places men were forbidden to appear topless into the 1930s. Standards loosened somewhat in Europe after World War II, but on this side of the Atlantic, navels remained unexposed. Rather than donning bikinis (which, according to Diana Vreeland, the legendary editor of *Vogue*, "revealed everything about a girl except her mother's maiden name"), American women forced themselves into "constructed" bathing suits that tended to conceal a good deal more than they revealed.

Spring break and surf movies. Beach house sprawl and seaside blight. Tans have gone from "the best thing that has ever happened to the American people" (in the words of New York City's Depression-era commissioner of health) to the sort of thing your mother warns you against. But even the cell phone won't kill the allure of the beach. "After all is said and done," the authors of this delightful impressionist survey conclude, "we still come to the beach to slip through a crack of time into the paradise of self-forgetfulness."

PEOPLE LOOKING TO THE SEASHORE AS a place to contemplate nature, life and humankind's position in a greater system may find themselves distressed by all the attention *The Beach* devotes to ourselves and our vigorous, unceasing activity. Paul Valéry's *Sea Shells* offers an antidote to that atmosphere of self-centered bustle.

A poetic essay written in 1936 and translated into English in 1964, *Sea Shells* paints in quiet observations rather than bright splatters of fact. The illustrations, 16 beautiful pencil drawings of shells by Henri Mondor, explore nuances of shading, curve and edge more than they portray biological reality. Yes, they show real shells: tuns and whelks, wentletraps and cones, miters and spindles and conchs. But like Edward Weston's black-and-white photographs of peppers, Mondor's drawings are free from distracting background and reveal neither color nor the slightest imperfection. Look at this form, they say, and marvel at it.

That, in essence, is the message of Valéry's delightful essay. Pick up a shell, he says, and revel in its elegance. "Run off by the billions, each different from the rest," seashells come in a fantasy of twisted sheets, spirals and helices. "Like a pure sound or a melodic system," he notes, shells "stand out from the common disorder of perceptible things." Who, a naive observer might ask, or what, could have made them?

Yes, shells are made by shellfish. But what exactly does that mean? While "a seashell emanates from a mollusk," that emanation is neither an exercise of intent nor an operation of chance. Shells are rather the mindless recitation of an ancient lesson, perfectly memorized and metronomically reproduced by generation after generation of these oddly gifted creatures.

Pick up a shell, Valéry says, and revel in its elegance. Seashells come in a fantasy of twisted sheets, spirals and helices.

A seashell reflects a life incomprehensibly distant from our own. A mollusk, like an ecosystem or the incalculable interplay of weather, wave and tide, "does not separate its geometry from its physics." Yet even the humblest of shells displays, says Valéry, "the sureness of execution, the inner necessity, the indissoluble bond between form and material" that human artists and artificers strive for. That mollusks, unthinking and utterly unaware, achieve such artless perfection is a phenomenon infinitely worth contemplating.

John R. Alden, an anthropologist and book reviewer, sunbathes on a granite slab in an abandoned quarry in Maine.

The Object at Hand [p. 24]

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Chinery Collection Website: www.chinery.com

Back Pain [p. 36]

Vermont Back Research Center, University of Vermont, 1 South Prospect St., Burlington, Vermont 05401; 1-800-527-7320; http://salus.med.uvm.edu/~backtalk

Spine Institute of New England, Box 1043, Williston, Vermont 05495

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Jacques-Louis David [p. 80]

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Art of Money [p. 108]

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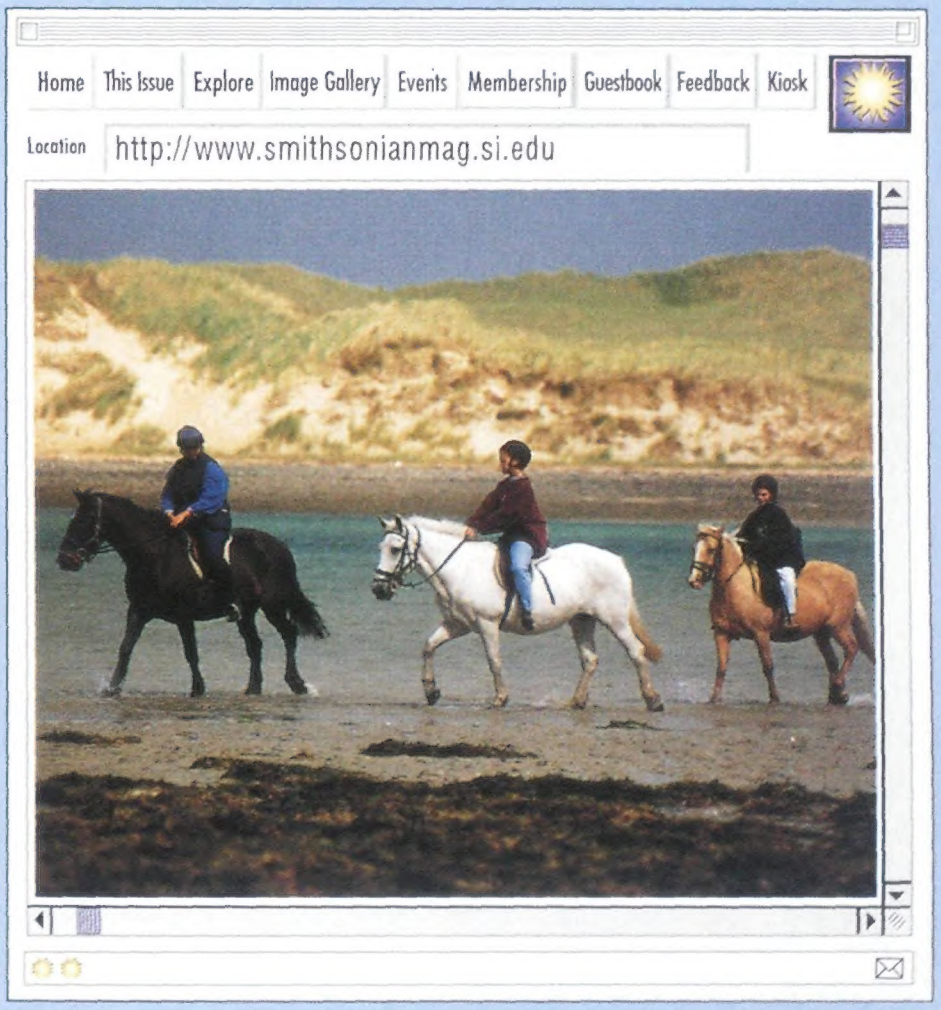

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Smithsonian (ISSN 0037-7333) is published monthly by the Smithsonian Associates, 900 Jefferson Drive, Washington, DC 20560.

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Editorial offices are at 900 Jefferson Drive, SW, Washington, DC 20560 (202-786-2900). Advertising and circulation offices are at 420 Lexington Ave., New York, NY 10170 (212-490-2510). **Subscription Prices:** United States and possessions: $24 a year payable in U.S. funds. Canada and all other countries: add $13 (U.S. funds) for each year. 80 percent of dues is designated for magazine subscriptions. Current issue price is $4 (U.S. funds). Back issue price is $5 (U.S. funds). Periodical postage paid at Washington, DC and additional mailing offices. **Mailing Lists:** From time to time we make our subscriber list available to companies that sell goods and services by mail that we believe would interest our readers. If you would rather not receive such mailings, please send your current mailing label, or an exact copy, to: Smithsonian, Mail Preference Service, P.O. Box 420311, Palm Coast, FL 32142-0311. **Subscription Service:** Should you wish to change your address, or order new subscriptions, you can do so by writing Smithsonian, P.O. Box 420311, Palm Coast, FL 32142-0311, or by calling 1-800-766-2149. Postmaster: Send address changes to Smithsonian, P.O. Box 420312, Palm Coast, FL 32142-0312. Printed in the USA.

THE LAST PAGE

Hell on Wheels

BY ALISON POWERS

I'M NOT VERY GOOD AT VACATIONS. I bring the wrong books, am afraid to tan and slur my words after one banana daiquiri. But this vacation was going to be different: a guided bicycle trip through the vineyards and rolling hills of France's Burgundy region. The brochure promised tree-lined back roads and a "leisurely pace ideal for the Sunday cyclist." I sent off my deposit with the clear and compelling image of myself in a flower-print sundress, a fresh baguette in my front basket, pedaling and waving "*Bonjour!*" to the friendly villagers.

Day 1: With 22 other Americans, I arrive by bus at a vine-covered chateau. I change into my best khaki shorts for our get-acquainted ride and wait in the garden for my fellow cyclists. First to join me is a man in neon spandex bicycle shorts, matching bicycle jersey, bicycle gloves and bicycle racing helmet. His black bicycle shoes cause him to hobble slightly as he walks. I smile reassuringly at him, certain that he feels ridiculous.

But wait! Here comes a woman in an equally elaborate outfit. Then another, and another, until it dawns on me that I will be spending the next seven days on the road with a group of toe-clip savvy, semiprofessional cyclists who reached optimal body fat ratios several thousand miles ago.

After five hours I'm having chest pain and can't breathe. Gasping, I careen off the road.

Day 2: The ride begins with a lecture from our guide on the importance of cycling together as a group. A few minutes later, my fellow cyclists, all jockeying for lead position, shrink to black specks on the horizon. Today, I perfect the French phrases for the following: "Have you seen a great number of bicycles?" "Yes, I am very tired." "One Orangina, please."

Day 3: From the beginning, I've complained to my guide that my bicycle is hard to pedal. Finally, I refuse to go another quarter of a kilometer until he takes a look. He quickly determines that for three days I've been cycling with one brake shoe locked against the front tire rim.

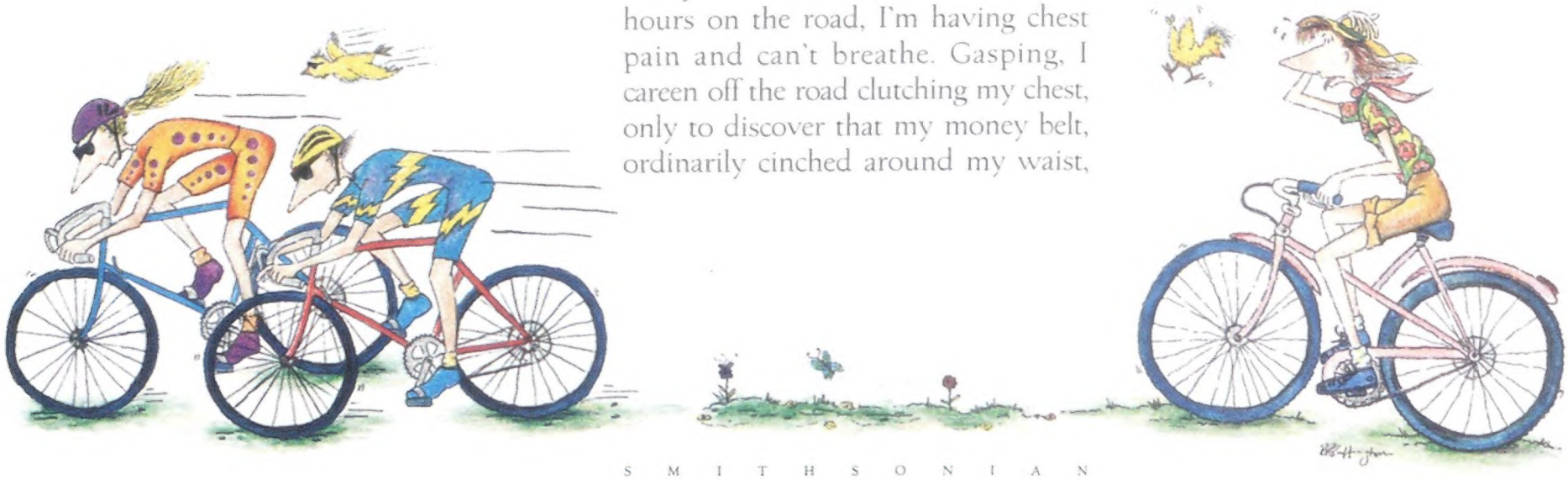
Day 4: Serious trouble. After five hours on the road, I'm having chest pain and can't breathe. Gasping, I careen off the road clutching my chest, only to discover that my money belt, ordinarily cinched around my waist, has crept up in ever-tightening circles to just under my new sports bra.

Day 5: Lost again, on a hot, humid afternoon in the middle of a bleak residential area. I reach down for my water bottle and find it empty. So I do what any seasoned traveler would do. I slide off my bike, lift it high above my head and heave it to the pavement. Then I rip the bright yellow helmet off my dripping head and hurl it into a concrete wall.

Day 6: Villagers at a small town see 22 bronzed, very determined cyclists streaming in synchronized precision through the main street. Hours later, a wheezing woman in baggy khaki shorts, filthy from a greasy bicycle chain, pedals slowly after them. Spectators gather along the sidewalk, clapping and shouting "*Bravo! Allez!*" My moment has finally come. I manage a weak smile.

Day 7: The best day of the trip. I ride with the luggage in the support van.

Next summer? I just read about a fantastic opportunity to go kayaking among glaciers in Alaska. "Perfect," says the brochure, "for beginning paddlers." Thanks, but I think I'll stay home and mow the lawn.



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